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Final
Environmental Impact Statement
May 1993

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Space Nuclear
Thermal Propulsion Program
Particle Bed Reactor Propulsion
Technology Development and Validation

94 7 7 044

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

OFFICE OF THE ASSISTANT SECRETARY

APR 2 8 1993

TO: ALL INTERESTED GOVERNMENT AGENCIES, PUBLIC GROUPS, AND INDIVIDUALS

Attached is the Final Environmental Impact Statement (EIS) for the Space Nuclear Thermal Propulsion (SNTP) Program. This document is provided in compliance with the regulations of the President's Council on Environmental Quality.

This document describes the potential environmental impacts of technology development of a Particle Bed Reactor (PBR) propulsion system. During the past decade the PBR technology has advanced to such a degree that the Air Force proposes to conduct validation testing of this technology for space propulsion as part of its SNTP program.

This document analyzes the potential environmental impacts at two candidate test locations, the Saddle Mountain Test Station at the Nevada Test Site and the Contained Test Facility at the Idaho National Engineering Laboratory, as well as the impacts of the No-Action Alternative.

The Record of Decision for this EIS is expected to be signed on 7 June 1993. For further information on this program, please contact:

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Brooks AFB, TX 78235-5318

We appreciate your interest in this matter.

GARY D. VEST
Deputy Assistant Secretary of the Air Force
(Environment, Safety and Occupational Health)

1 Attachment
Final EIS

FINAL

ENVIRONMENTAL IMPACT STATEMENT

SPACE NUCLEAR THERMAL PROPULSION PROGRAM

Particle Bed Reactor Propulsion Technology Development and Validation

MAY 1993

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COVER SHEET

FINAL ENVIRONMENTAL IMPACT STATEMENT
SPACE NUCLEAR THERMAL PROPULSION PROGRAM

a. Responsible Agency: U.S. Air Force

b. Cooperating Agency: Department of Energy

c. Proposed Action: Technology development through validation testing of a particle bed reactor (PBR) propulsion system.

d. Written comments and inquiries on this document should be directed to: Capt. Scott Hartford, AFCEE/ESEP, 8106 Chennault Road, Brooks AFB, TX 78235-5000.

e. Designation: Final Environmental Impact Statement (FEIS)

f. Abstract: The PBR concept has been under study in the United States since the early 1980s. During the past decade the PBR technology has advanced to the degree that the Air Force, in carrying out its mission to investigate promising technologies for military applications, proposes to conduct validation testing of the PBR technology for space propulsion as part of its Space Nuclear Thermal Propulsion (SNTP) program. This environmental impact statement has been prepared in accordance with the National Environmental Policy Act to analyze the potential environmental consequences of the proposed PBR construction and testing activities. The document analyzes the potential environmental impacts at two candidate test locations, the Saddle Mountain Test Station at the Nevada Test Site, and the Contained Test Facility at the Idaho National Engineering Laboratory, as well as the impacts of the No-Action Alternative. The analyses include infrastructure, land use, transportation, hazardous materials and hazardous waste management, biological resources, cultural resources, geology and soils, noise, water resources, and health and safety. Anticipated issues related to health and safety will be addressed in facility designs and safety procedures so that applicable statutes, regulations, and permits are met or exceeded. The program would cause slight increases in utility demands, population, air emissions, and disposal of hazardous waste. Additional small releases of radioactivity would occur due to normal operations or from an accident. Construction would cause loss of habitat at either site; in-place mitigations at the Nevada Test Site would minimize impacts to the desert tortoise (a federally listed threatened species). A warning siren or other deterrent could be used at INEL to lessen the remote likelihood of impacts to the bald eagle (a federally listed endangered species) from flare stack operations. No impacts that exceed applicable limits have been identified at either candidate test location, although SNTP in combination with other potential future programs may deplete existing disposal capacity for low-level radioactive waste more quickly then when considered separately.

SUMMARY

PURPOSE OF AND NEED FOR ACTION

This environmental impact statement (EIS) analyzes the potential environmental consequences of implementing a proposal to perform testing associated with the Space Nuclear Thermal Propulsion (SNTP) program. The SNTP program is an activity to pursue development of nuclear reactor technologies that have potential application to advanced space propulsion systems. In support of its mission, the Air Force has a continuing need to investigate new and promising technologies. The Air Force has tasked the Space and Missiles Technology Directorate of the Phillips Laboratory with the responsibility for validating and using advanced technologies to acquire and maintain superior space propulsion systems. Based on its technical merits, a nuclear technology known as a particle bed reactor (PBR) has been identified for validation for potential application as an advanced upper stage propulsion system.

The Air Force must comply with provisions of the National Environmental Policy Act (NEPA), which require preparation of an EIS. This study provides information to the decision makers and the public on the potential environmental impacts that could result from proceeding with development of the PBR propulsion technology through validation testing. The Department of Energy (DOE) is a cooperating agency in the preparation of this EIS and will participate with the Air Force in making decisions regarding the technology validation.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

The Air Force proposes to develop the technology and demonstrate the feasibility of a PBR propulsion system that could be used to power an advanced upper stage rocket engine. The Proposed Action for this technology development program consists of development and testing of the engine and propellant management system components and assemblies, and construction and operation of validation testing facilities.

The PBR propulsion system would include a nuclear reactor consisting of an arrangement of fuel elements containing uranium-235 fuel particles, each one coated to provide containment of radioactive fission products. Cryogenic hydrogen would flow through the reactor and be heated as a result of cooling the fuel. The heated hydrogen would be expanded through the nozzle assembly, producing thrust.

A series of tests would be performed, leading to the validation of the concept. Tests would be sequenced to begin with testing of multiple assemblies to demonstrate reactor fuel element operation, progress through

tests to demonstrate the propellant management system, and culminate in testing a series of up to ten reactors that gradually approach the desired performance conditions. Each test sequence would undergo a comprehensive safety analysis in accordance with DOE procedures for preliminary and final Safety Analysis Reports. Testing would be conducted in strict compliance with all applicable safety and environmental regulations and standards.

Two alternative PBR validation test sites are being considered as part of the Proposed Action:

- Construction and operation of the PBR validation test facilities at the Saddle Mountain Test Station (SMTS) at the Nevada Test Site (NTS) is being considered. NTS is a DOE installation located in southern Nevada. Development of the facilities would involve construction on approximately 100 acres at the SMTS. Infrastructure improvements such as road improvements and water and electric power service extensions would be required.

- Renovation of existing facilities and construction of some new facilities at the Contained Test Facility (CTF) at the Test Area North (TAN) area of the Idaho National Engineering Laboratory (INEL) is being considered. INEL is a DOE installation located in east-central Idaho. Development of the PBR validation test facilities would involve the renovation of existing facilities on approximately 55 acres of developed land plus additional acreage for construction of the remaining needed facilities. The total developed area would be approximately 100 acres.

The only alternative to the Proposed Action being considered is the No-Action Alternative. The No-Action Alternative would result in not carrying out the development and validation process for the PBR propulsion technology. Development of testing facilities would not occur under this alternative.

The Air Force's preferred alternative is to facilitate development of nuclear thermal propulsion technology by constructing and operating a PBR validation test facility. While both NTS and INEL appear to be acceptable candidate locations for the test facility, the Air Force presently prefers NTS.

The Air Force's final decision, as well as DOE's site selection, will be documented in one or more formal Records of Decision that will be made available to the public.

SCOPE OF STUDY

The scoping period began when the Notice of Intent to prepare an EIS for the SNTP program was published in the *Federal Register* on March 13,

1992. Issues related to the SNTP program were identified in scoping meetings held in Las Vegas, Nevada (April 7, 1992); Idaho Falls, Idaho (April 9, 1992); St. George, Utah (April 16, 1992); and Salt Lake City, Utah (April 22, 1992). The comments and concerns expressed at the scoping meetings and received during the public comment period were used in determining the scope and direction of studies and analyses required to accomplish this EIS.

This EIS discusses the potential environmental impacts associated with implementation of the Proposed Action, its siting alternatives, and the No-Action Alternative. To provide the context in which potential environmental impacts may occur at the two candidate field test locations and the surrounding communities, existing conditions and potential changes as a result of construction and test activities are described. Impacts to the physical and natural environment are evaluated for infrastructure, land use, transportation, hazardous materials/waste management, air quality, biological resources, cultural resources, geology and soils, noise, water resources, and health and safety.

SUMMARY OF ENVIRONMENTAL IMPACTS

This EIS considers the environmental impacts of proceeding with PBR technology development and validation and whether to perform the testing operations at the SMTS or the CTF. For purposes of summarizing and comparing environmental impacts, the alternatives are arranged as follows: proceeding with the Proposed Action at the SMTS, proceeding with the Proposed Action at the CTF, and the No-Action Alternative.

Influencing factors include projections based on program requirements that would likely influence the biophysical environment, including ground disturbance, socioeconomic factors, and infrastructure demands, as well as environmental (biophysical) impacts of the alternatives. Influencing factors and environmental impacts are summarized below and in Table S-1.

SUMMARY OF PUBLIC COMMENTS

The Draft EIS (DEIS) for the SNTP program was made available for public review and comment from August to October 1992. Public hearings were held in Las Vegas, Nevada (September 8, 1992); St. George, Utah (September 10, 1992); Salt Lake City, Utah (September 15, 1992); and Idaho Falls, Idaho (September 17, 1992). At each of these the Air Force presented the findings of the DEIS. Public comments received both verbally at the public hearings and in writing during the response period have been reviewed and are addressed in Chapter 9 of this EIS. In addition, the text of the EIS itself has been revised, as appropriate, to discuss the concerns expressed in the public comments.

Table S-1. Summary of Impacts from Alternatives

	Proposed Action at SMTS	Proposed Action at CTF	No-Action
Local Community			
Land Use	No impact	No impact	No impact
Population	263; less than 0.04% increase	263; less than 0.2% increase	No impact
Employment	100 personnel; 2% increase	100 personnel; less than 1% increase	No impact
Transportation	Maximum of 5.9% increase in AADT	Maximum of 6.1% increase in AADT	No impact
Utilities			
Water	Less than 0.5% increase in withdrawal	Less than 0.1% of allocation	No impact
Electrical	New distribution line to the site required; 0.75 MW peak power requirement	Less than 1% of existing capacity required	No impact
Wastewater	2,400 gal/day: septic system/leachfield to be constructed	2,400 gal/day: less than 1% of existing capacity to be used	No impact
Solid Waste	Less than 1% increase	Existing landfill site contains sufficient capacity for solid wastes	No impact
Hazardous Materials/Waste			
Materials	Shipment of less than 220 pounds of U-235 per year (as part of component assemblies)	Shipment of less than 220 pounds of U-235 per year (as part of component assemblies)	No impact
Waste	Less than 2% increase per year	Less than 1% increase per year	No impact
CERCLA	No impact	No impact	No impact
Radioactive Materials	Approximately 9% of existing capacity for disposal of low-level waste (LLW) required.	Approximately 46% of existing capacity for disposal of LLW required. LLW with TRU greater than 10 nanocuries per gram (PBR fuel elements that would be much less than 1 percent of total LLW) would be stored at existing INEL storage area; ultimate disposal is pending DOE revisions to waste management practices.	No impact
Natural Environment			
Air Quality	Slight increases in PM_{10} emissions and emissions from construction and worker vehicles. No impact on air basin attainment.	Slight increases in PM_{10} emissions and emissions from construction and worker vehicles. No impact on air basin attainment.	No impact
Biological Resources	Up to 1,000 Joshua trees impacted by construction; temporary impacts to wildlife during operations due to noise; no impact to sensitive habitats; loss of 100 acres of vegetation; possible loss of birds in flare stack. Road maintenance could impact desert tortoise; implementation of existing mitigations would be required.	Temporary impacts to wildlife during operations due to noise; no impact to sensitive habitats or threatened and endangered species; possible loss of birds in flare stack (bald eagles are known to occur in nearby mountain areas but mitigation measures could reduce potential impacts); loss of less than 50 acres of previously disturbed vegetation.	No impact
Cultural Resources	No adverse impacts	No adverse impacts to potentially significant historic resources (CTF) if mitigations identified by consultation process are implemented.	No impact
Geology & Soils	26,000 cubic yards of cut, 37,000 cubic yards of fill; new construction required to meet standards for Seismic Zone 4	11,000 cubic yards of excavation. New construction required to meet standards for Seismic Zone 2B; new facilities are located in likely floodplain; however mitigation measures could reduce potential impacts.	No impact
Noise	Temporary impacts to wildlife during operations; 390 acres exposed to 60 dBA or greater	Temporary impacts to wildlife during operations; 390 acres exposed to 60 dBA or greater	No impact
Water Resources	No impact on water table or water quality	No impact on water table or water quality	No impact
Health and Safety*			
Maximum Yearly Release	0.16% of environmental dose	0.34% of environmental dose	No impact
Total Lifetime Dose	0.07% of environmental dose	0.14% of environmental dose	No impact
Maximum Case Accident	6.1% of environmental dose**	7.5% of environmental dose**	No impact

* Exposures are shown for a hypothetical maximally exposed individual; average exposures would be much less.
** Assumes no evacuations and no mitigation measures.

SUMMARY OF CHANGES FROM THE DEIS TO THE FINAL EIS (FEIS)

Based on more recent studies or comments from the public, the following major changes have been made to the EIS:

- Additional discussion of Purpose and Need (Sections 1.2 and 1.3) is provided
- Additional details on the description of the Proposed Action are provided (Section 2.0)
- Analysis of roads accessing the SMTS (traffic, biological resources) is added (Section 4.4.1 and 4.7.1)
- The potential for impacts from the SNTP program and the Yucca Mountain (Nevada) Waste Repository site characterization process is discussed (Sections 4.3.1 and 4.4.1.1)
- Clarification of radioactive waste classification is provided (Section 3.5). Additional information on hazardous and radioactive wastes is provided for both NTS and INEL. (Sections 4.5.1 and 4.5.2)
- Additional information on potential DOE actions regarding environmental restoration of DOE facilities, revisions to DOE waste management policies and procedures, and consolidation (reconfiguration) of the U.S. nuclear weapons production facilities and the potential for cumulative impacts for hazardous waste management is provided (Sections 2.7, 4.5.1.4, and 4.5.2.4)
- Additional discussion of potential Native American interests is provided (Sections 3.8.1, 3.8.2, 4.8.1, and 4.8.2)
- Text is revised to incorporate the results of a recent study that no transuranic (TRU) waste would be generated (Sections 3.5 and 4.5)
- Additional discussion on seismic and volcanic conditions at NTS and INEL is provided (Sections 3.9 and 4.9)
- Quantities of cryogenics are shown for the total validation test program rather than for a single test (Section 2.3).
- The Health and Safety discussions (Sections 3.12, 4.12, and Appendix E) are modified to enhance clarity, including minor modifications to some analyses to make them more consistent.

Chapter 9 discusses the comments received from the public review process for the Draft EIS. A number of these comments requested additional details of design, analysis, and specific results, particularly in context of radioactive releases, accident scenarios, and public health and safety. Some of these details were provided where appropriate, but many of these details are more applicable to a DOE-required Safety Analysis Report (SAR) process, which would be performed subsequent to this environmental analysis. The environmental analysis was based on bounding conditions, using conservative assumptions (i.e., resulting in more severe impacts); the SAR studies would include more detailed studies, based on less conservative, more realistic assumptions. As a result, the SAR process is expected to predict impacts less severe than those presented in the EIS. If in fact the SAR process identifies greater impacts, additional analysis would be required.

IMPLEMENTING THE PROPOSED ACTION AT SMTS

Community Setting/Influencing Factors

The community region of influence for the SMTS includes Nye and Clark counties, Nevada, including the city of Las Vegas. The program would require a maximum of 100 personnel during the peak construction period. Even if it is assumed that all such personnel would move into the area from outside the region of influence, there would be a negligible effect on *population, local economy,* and *support service availability.*

A new power line within the NTS power grid would be required; however, there is sufficient power at NTS to support this line. Generation of solid waste, use of water, and production of wastewater would represent a small increase in the total requirements, given existing capacities and past consumption levels.

No land use conflicts are anticipated as a result of implementing the Proposed Action at the SMTS. The testing activities would be consistent with the type of research conducted at NTS. No impacts to the Yucca Mountain Waste Repository site characterization process are expected.

Traffic due to the Proposed Action being implemented at the SMTS would result in a small increase on the main route connecting NTS to Las Vegas (U.S. 95). No adverse effects are expected.

Biophysical Environment

Transportation of hazardous materials (both radioactive and nonradioactive) would comply with all applicable regulations, and no impacts are expected. Storage and use of hazardous materials would be consistent with current operations at NTS.

Nonradioactive and radioactive hazardous wastes would be disposed of in existing disposal facilities. All such facilities have sufficient capacity to support the SNTP program. Implementation of potential DOE environmental restoration and waste management activities may change specific disposal sites/procedures, and existing low level waste disposal space may be filled more quickly, but DOE's capability to dispose of SNTP wastes would be maintained. SNTP activities are not expected to impact the Yucca Mountain site characterization and potential site selection process of the waste repository.

Air quality impacts resulting from implementation of the Proposed Action at the SMTS would include emissions of fugitive dust (particulate matter less than 10 microns in diameter [PM_{10}]) and exhaust emissions from vehicles and generators involved with both construction and operations. Control of PM_{10} would minimize any impacts, and the use of diesel generators may require permits from the state. No air quality impacts are expected from PBR test exhausts. The hydrogen flare stack ignition system may cause very small quantities of carbon monoxide (CO), nitrogen dioxide (NO_2), and particulate matter (PM_{10}). These emissions are not expected to add substantially to the regional air pollution inventory; however, applicable permits may be required.

Implementing the Proposed Action at the SMTS would result in the loss of up to approximately 100 acres of low quality vegetation. Approximately 1,000 Joshua trees would be removed as a result of facility construction and infrastructure improvement needs. Operation of the flare stack could be a fire hazard to nearby vegetation if vegetation control measures are not implemented. Minimal wildlife impacts would be expected; noise from the flare stack would frighten some animals temporarily, and any birds flying into the hydrogen flare would be killed. No impacts to threatened or endangered species are expected as a result of program activities at the SMTS. However, potential impacts to the desert tortoise (a threatened species) could arise from road maintenance and/or traffic to the site. These potential impacts would be minimized by existing NTS mitigation measures. No sensitive habitats would be affected as a result of the Proposed Action at the SMTS.

No adverse impacts to archaeological, historical, Native American, or paleontological resources are expected if the Proposed Action is implemented at the SMTS.

No adverse impacts to geology, topography, or soils are expected; however, localized temporary soil erosion would occur during ground-disturbing construction activities. While effects from seismic activity are unlikely, accidents resulting from seismic events are included in Health and Safety analyses. Effects from potential ground motion induced by NTS underground testing (UGT) would be mitigated by designing and building the

facilities in conformance with Seismic Zone 4 (greatest seismic risk zone) construction requirements.

No noise impacts to non-project personnel or sensitive receptors are expected. Project personnel would comply with Occupational Safety and Health Administration noise limits and preventive/protective measures. Local wildlife would experience occasional temporary startle/fright effects.

Water use associated with implementing the Proposed Action at the SMTS would result in a slight increase in water withdrawal from the aquifer. No water quality or surface water impacts are expected from normal operations.

Health and Safety

Radiological hazards associated with normal reactor test operations, radioactive material transportation, and accidents were evaluated. Analyses were performed using selected computer modeling codes, with inputs determined through selection of bounding case weather conditions (i.e., causing greatest impact), radioactive releases, and controls.

Three types of planned operations using two different sized reactor cores were identified. The smaller of these two reactors, the PBR Integral Performance Element Test (PIPET) reactor, would be used in the first self-sustained power-producing test of multiple PBR element assemblies; whereas the larger of the two, the Ground Test Article (GTA), would involve testing a complete PBR core to gradually approach desired system performance conditions. Planned operations correspond to low-power and full-power testing of the PIPET reactor core, beyond full-power testing of this smaller reactor, and both low- and full-power tests using the larger GTA. Potential radiological releases were analyzed for all planned operational scenarios.

Modeling of potential radiological impacts was performed for the maximum case year (the largest numbers of operations expected in a single year) and the proposed test program lifetime. Results from the maximum-case year are less than 1 percent of the environmental radiation in the NTS vicinity, and are well below both the Environmental Protection Agency (EPA) emission standards and the SNTP program goal of no more than 20 percent of applicable regulatory limits. Potential impacts of the test program on cancer fatalities and genetic defect rates were found to be extremely low relative to the normally expected occurrences in the exposed population.

Accident situations, using extremely conservative analysis methods, were also evaluated and a complete analysis performed for the identified maximum impact case: a release of a significant fraction of a PIPET core fission product inventory during atmospheric conditions corresponding to maximum credible impacts. (Note: A similar accident scenario involving a

GTA core was considered but rejected from further analysis when it was found that no reasonable event could cause such an occurrence). Results of the PIPET analysis indicate that the total dose to a hypothetical maximally exposed individual (MEI) would be well below accident-case siting guidelines. The total impact on cancer fatalities and genetic defect rates due to a maximum-case accident would be extremely low relative to the normally expected occurrences in the exposed population.

IMPLEMENTING THE PROPOSED ACTION AT THE CTF

Community Setting/Influencing Factors

The community region of influence for the CTF includes those portions of a six-county area (Bannock, Bingham, Bonneville, Butte, Jefferson, and Madison counties) within 50 miles, including Idaho Falls. The program would require a maximum of 100 construction personnel during the peak construction period. Negligible effects on population, local economy, and support service availability would result.

Electricity, solid waste, wastewater, and water supply consumption would represent only small increases in the total requirement, given existing capacities and past consumption levels. No land use conflicts are anticipated as a result of implementing the Proposed Action at the CTF due to the nature of current research activities at INEL.

Traffic due to implementing the Proposed Action would represent a small increase on roads accessing the CTF (U.S. 33). Traffic on public roads traversing INEL may have to be rerouted during and immediately after some test operations. No adverse effects are expected.

Biophysical Environment

Transportation of hazardous materials (both radioactive and non-radioactive) would comply with all applicable regulations, and no impacts are expected. Storage and use of hazardous materials would be consistent with current operations at INEL.

Non-radioactive and radioactive hazardous wastes would be stored and/or disposed of in existing storage and/or disposal facilities. All such facilities would have sufficient capacity to support the SNTP program. An INEL performance goal for low level waste (LLW) disposal restricts disposal of LLW with transuranic element (TRU) content of 10 to 100 nanocuries per gram. Much less than one percent of projected SNTP LLW would fall in this category (approximately 450 to 1,000 kilograms [990 to 2,200 pounds]). This LLW would be stored at existing INEL storage area; ultimate disposal is pending ongoing DOE revision to waste management practices.

Potential actions currently being studied by the DOE (environmental restoration of DOE facilities, revision of DOE waste management policies and procedures, and reconfiguration of the U.S. nuclear weapons production complex) may have cumulative effects with PBR validation testing in that they could hasten the depletion of existing LLW disposal capacity. However, this situation would not reduce DOE's capability to dispose of SNTP LLW.

Air quality impacts that would occur from implementation of the Proposed Action at the CTF would include PM_{10} emissions and exhaust emissions from construction and operations (vehicles and generators). Control of PM_{10} would minimize any impacts. No air quality impacts are expected from PBR test exhausts. The hydrogen flare stack ignition system may cause very small quantities of carbon monoxide (CO), nitrogen dioxide (NO_2), and particulate matter (PM_{10}). These emissions are not expected to add substantially to the regional air pollution inventory nor affect attainment status. Any required permits would be obtained.

Implementing the Proposed Action at the CTF would result in the loss of approximately 50 acres of previously disturbed, low quality vegetation. Operation of the flare stack could be a fire hazard to nearby vegetation if vegetation control measures are not implemented. Minimal wildlife impacts would be expected due to the developed nature of the area. Noise from the flare stack would frighten some animals temporarily, and any birds flying into the hydrogen flare would be killed. Although one endangered species (the bald eagle) has been observed in the area, minimal impacts are expected as a result of program activities. No sensitive habitats would be affected as a result of the proposed action at the CTF.

The existing containment structure at the CTF has been determined eligible for the National Register of Historic Places by the Idaho State Historic Preservation Office (SHPO); possible adverse impacts are being mitigated through consultation with the State Historic Preservation Officer. No adverse impacts to archaeological, Native American, or paleontological resources are expected.

No adverse impacts to geology or soils are expected. The natural topography near the site may be subjected to flooding; however, the CTF elevation has been raised to keep the existing facilities at the site from being flooded. New SNTP facilities are sited in a likely floodplain; these facilities would be similarly raised and/or protected by flood-control barriers in accordance with Executive Order 11988 (3 CFR, 1979 Compilation, p. 412). Localized temporary soil erosion would occur during ground-disturbing construction activities. Effects from seismic and volcanic activity are unlikely; accidents resulting from possible seismic events are included in the Health and Safety accident analyses.

No noise impacts to non-project personnel or sensitive receptors are expected. Project personnel would comply with Occupational Safety and Health Administration noise limits and preventive/protective measures.

Water use from implementing the Proposed Action at the CTF would have negligible effects on drawdown in the aquifer and it would not affect contaminated water being cleaned at the TAN. No water quality or surface water impacts are expected from normal operations.

Health and Safety

Radiological hazards associated with normal and accidental reactor test operations and radioactive material transportation were evaluated. Analyses were performed using selected computer modeling codes, with input determined through selection of bounding case (i.e., causing greatest impact) weather conditions, radioactive releases, and controls.

Three types of planned operations using two different-sized reactor cores were identified. The smaller of these two reactors, the PIPET reactor, would constitute the first self-sustained power-producing test of multiple PBR element assemblies; the larger of the two, the GTA, would involve testing a complete PBR core to gradually approach desired system performance conditions. Planned operations correspond to low-power and full-power testing of the PIPET core, beyond full-power testing of this smaller reactor, and both low- and full-power tests using the larger GTA. Potential radiological releases were analyzed for all planned operational scenarios.

Modeling was performed for the maximum-case year (the largest numbers of operations in a single year) and the proposed test program lifetime. Results from the maximum-case year are less than 1 percent of the environmental radiation dose in the INEL vicinity, and well below both EPA emission standards and the SNTP program goal of no more than 20 percent of applicable regulatory limits. Potential impacts of the test program on cancer fatalities and genetic defect rates were found to be extremely low relative to the expected occurrences in the exposed population.

Accident situations, using extremely conservative analysis methods, were also evaluated and a complete analysis performed for the identified maximum-impact case: a release of a significant fraction of a PIPET core fission product inventory during atmospheric conditions corresponding to maximum credible impacts. (Note: A similar accident scenario involving a GTA core was considered but rejected from further analysis when no reasonable events could be found that would cause such an occurrence). Results of this analysis indicate that the total dose to a hypothetical maximally exposed individual (MEI) would be well below accident-case allowable exposures. The total increase in cancer fatalities and genetic

defect rates due to a maximum-case accident would be extremely low relative to the expected occurrences in the exposed population.

NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the Air Force would not proceed with PBR technology development and validation. Other unrelated current activities at NTS and INEL would continue. No construction of new facilities would occur at the SMTS, and no modification or construction of facilities would occur at the CTF.

Because none of these activities would take place, no impacts beyond those occurring as a result of other current or future programs or activities would result. No effects would occur in any of the influencing factors or biophysical resource areas.

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1.0 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

This environmental impact statement (EIS) analyzes the potential environmental consequences of proceeding with a proposal to perform ground-based testing associated with the Space Nuclear Thermal Propulsion (SNTP) program. The SNTP program is an activity to pursue development of nuclear reactor technologies with potential application to advanced space propulsion systems. The program would develop and demonstrate the feasibility of high temperature nuclear thermal propulsion technologies. Upon successful completion of a developmental and feasibility effort, high temperature nuclear reactor propulsion systems could be applied to both future advanced upper stage rocket engines and orbital transfer vehicles.

The Air Force currently considers the Particle Bed Reactor (PBR) propulsion technology to have sufficient developmental potential to warrant continued investigation. This EIS evaluates the potential environmental impacts associated with the Proposed Action, which is to develop and validate PBR technology. This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council on Environmental Quality (CEQ) regulations implementing the NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508).

Appendix A includes a glossary of terms used, a list of acronyms and abbreviations, and a separate list of the symbols used for elements/chemicals discussed.

1.1 BACKGROUND

In the early 1980s, scientists at Brookhaven National Laboratory, New York, developed the PBR concept. After years of refinement, this concept currently consists of a bed of very small, ceramic-coated particles containing nuclear material that are allowed to undergo a fission (atom splitting) reaction. The intense heat from the fission reaction is removed from the reactor by forcing a super-cooled gas through the reactor body and around the particles; in the process the gas becomes superheated.

Use of very small, ceramically coated spheres maximizes the surface area over which the gas can flow, resulting in very efficient transfer of heat from the fuel particles to the gas. This arrangement also maximizes the production of neutrons, which are both a product of the fission reaction and necessary to sustain it. These two factors - maximum particle surface area and high neutron production - produce a very high level of power output from a very small quantity of fuel; in other words, the PBR has a very high power density.

These features soon led to designs that exploited the high power density of the PBR. One of the most compelling of these applications is the PBR nuclear rocket engine. The PBR engine would be a new type of nuclear reactor that would use hydrogen as both a reactor coolant and a propellant. In doing this, the high power density of the PBR, in conjunction with the low molecular weight of the hydrogen, would allow both a high thrust-to-weight ratio and a high specific impulse (I_{sp}) (which relates to the efficiency at which propellant is used to produce thrust). If validated, this concept would enable a substantial number of missions not possible with other propulsion systems whose design and geometrical configurations limit either the I_{sp} or thrust-to-weight ratio.

Recently, the government and industry have advanced the PBR technology for potential applications to space propulsion. In 1989 each Service Secretary attested to the breakthrough potential and utility of the concept (Atwood, 1989). Further, the concept has been reviewed by two independent Defense Science Boards (DSBs) (1990 DSB Task Force on Special Technology and 1989 DSB on National Launch Strategy). Both of these DSBs confirmed the need for development of advanced propulsion systems and endorsed the PBR propulsion technology development specifically. The DSB Task Force on Special Technology concluded, in part, that:

- The PBR propulsion technology is technically sound and could provide twice the performance (I_{sp}) of conventional chemical propulsion.
- The PBR propulsion technology can be validated in conformance with all safety and environmental criteria.
- Potential national benefits could be obtained from follow-on applications in military, commercial/industrial, energy, and other space programs.
- Development of the PBR propulsion technology deserves broad support.

Other potential nuclear thermal reactor concepts with similar performance objectives have been proposed for advanced space propulsion. Detailed evaluation of these concepts by several governmental agencies, which included a second DSB evaluation in 1992, concluded that:

- The SNTP program is worthy of continued support to develop and validate PBR propulsion technology.
- PBR propulsion development and validation would provide a significant contribution to the knowledge and capability of future space exploration.

The Air Force, through the SNTP program office, is leading and coordinating the technical, safety, environmental, and management activities of the Department of Defense (DOD), the Department of Energy (DOE), and the National Aeronautics and Space Administration (NASA). DOE would be responsible for the test site and associated test facilities and for the nuclear aspects of the program such as operations and testing, nuclear requirements, and nuclear safety.

1.2 NEED FOR THE ACTION

Part of the Air Force's basic objectives is to be able to propel aircraft and rockets (Section 1.3). To maintain its capability and improve its effectiveness and efficiency, the Air Force needs to perform research, development, and validation of new technologies that could accomplish these objectives. Some of the activities include specific technology development to support specific missions, others are technologies to prove a new aerospace concept. To support development of new aerospace concepts, several technologies, both conventional and nuclear, have been and continue to be considered as viable research options. PBR propulsion technology has been viewed by the Air Force as a concept with distinct advantages over conventional propulsion capabilities. Based on technical merit, the Air Force considers the PBR propulsion technology as the most noteworthy option for continued research and development on the basis of the following:

- High power density would enable a high thrust-to-weight ratio
- High I_{sp} (roughly two to three times that of conventional chemical systems) would substantially reduce propellant quantities required, thereby increasing payload capacities
- Broad applicability, enabling several new missions requiring advanced upper stage rocket engines or orbital transfer vehicles.

1.3 PURPOSE OF THE ACTION

This program is being performed in accordance with the National Space Policy Directive 6, dated March 9, 1992, and signed by the President, in which NASA, DOD, and DOE are specifically directed "to continue technology development of space nuclear power and propulsion while ensuring that these activities are performed in a safe and environmentally acceptable manner and consistent with existing laws and regulations, treaty obligations, and agency mission requirements." The purpose of the action is twofold. First, in order to be a technologically superior force in the future, the Air Force has a continuing mission to investigate new and promising technologies that may have potential application to (1) increase global projection of power, (2) reduce the cost of military operations, and (3)

reduce logistics aspects of maintaining its military force structure. Second, there is a corresponding mission to investigate specific concepts that can meet future Air Force needs. With regard to this, the Air Force has tasked the Space and Missiles Directorate of the Phillips Laboratory (a unit within the Air Force) with the responsibility to validate and use advanced technologies to acquire and sustain superior systems capability in areas of space power and propulsion. The ultimate utility of these advanced technologies is also contingent on their technical viability, cost-effectiveness, and the overall safety strategy employed in their use.

Substantial conceptual and technical data exist to characterize the PBR technology; however, additional information is needed to support application of this technology to advanced propulsion systems. The purpose of the SNTP program would be to demonstrate the technical and economic feasibility and safety of the PBR technology in propulsion applications, including continued research and development addressing necessary materials and other supporting technologies. The SNTP program office has focused its efforts on validation of the PBR technology for these applications and has established a *requirements matrix* generated from documented mission needs, calling for less expensive and more operationally effective access to space. This could be achieved by implementing the nuclear thermal propulsion system in an upper stage configuration. Validation of the technology would be accomplished through a series of ground-based partial- and full-power tests to determine whether further system development and integration are warranted.

The proposed PBR validation test facility would be designed with as much flexibility as possible to accommodate the development and validation needs of future nuclear thermal propulsion technology programs. While further NEPA documentation may be required for future programs, the advantage of this design flexibility is in providing an established facility that could be cost-effectively modified to accommodate testing requirements.

1.4 DECISIONS TO BE MADE

As the lead agency, the Air Force is preparing this EIS to provide the decision makers and the public with the information required to understand the potential environmental consequences *resulting from* construction of a test facility and PBR development and validation testing. After completion of the EIS, one or more Records of Decision (ROD) will be issued relative to efforts associated with the SNTP program. The ROD(s) will determine the following:

- Whether to continue the SNTP program through the development of nuclear thermal propulsion technology

- Whether to construct and operate a PBR validation test facility

- Where to locate the PBR validation test facility if the program is to continue.

This EIS is limited to the PBR propulsion technology development and validation portions of the SNTP program. Further testing will not be planned unless the PBR propulsion technology development and validation program is successful. Further NEPA documentation would be prepared prior to any decisions on additional test programs, should follow-on activities be pursued.

1.5 ENVIRONMENTAL IMPACT ANALYSIS PROCESS

The NEPA of 1969 established a national policy to protect the environment by requiring that federal agencies consider the environmental effects of actions in their decision-making. NEPA also established the CEQ to oversee and recommend national policies to improve the quality of the environment. Subsequently, CEQ published regulations that described how NEPA should be implemented. The CEQ regulations encourage federal agencies to develop and implement procedures that address the NEPA process, in order to avoid or minimize adverse effects on the environment. Air Force Regulation (AFR) 19-2 addresses implementation of NEPA as part of the Air Force planning and decision-making process. Regulation 10 CFR 1021 implements NEPA for DOE decision making.

NEPA and AFR 19-2 contain guidance on the types of actions for which an EIS must be prepared. Once it has been determined that an EIS must be prepared, the proponent must publish a Notice of Intent (NOI) to prepare an EIS. This formal announcement signifies the beginning of the scoping period, during which the major environmental issues to be addressed in the EIS are identified. A Draft EIS (DEIS) is prepared, which includes the following:

- A statement of the purpose of and need for the action
- A Description of the Proposed Action and Alternatives, including the No-Action Alternative
- A description of the environment that would be affected by the action and alternatives
- A description of the potential environmental consequences of the action and alternatives.

The DEIS is filed with the Environmental Protection Agency (EPA), and is circulated to interested public and government agencies for a period of at least 45 days for review and comments. During this period, a public hearing may be held so that the proponent can summarize the findings of the

analysis and receive input from the affected public. At the end of the review period, all substantive comments received must be addressed. A Final EIS (FEIS) is produced that contains responses to comments as well as changes to the document, if necessary.

The FEIS is then filed with the EPA and distributed in the same manner as the DEIS. Once the FEIS has been available for at least 30 days, the ROD for the Action may be published.

The Proposed Action, including two alternative validation testing sites, and a No-Action Alternative have been identified for the SNTP program. The two sites are the Saddle Mountain Test Station (SMTS) at Nevada Test Site (NTS), and the Contained Test Facility (CTF) (formerly known as the Loss-of-Fluid Test site) at Idaho National Engineering Laboratory (INEL). The SMTS site would require new construction for all of the facilities; some existing facilities would be modified and reused at the CTF, while some new construction would be required. Although an earlier site narrowing report (summarized in Appendix F) identified the SMTS as being a preferred site, the Air Force and DOE have determined that both proposed sites are to be considered equally in this EIS, and the preferred alternative is discussed in Section 2.6.

The Air Force has prepared this EIS in cooperation with DOE. As a cooperating agency, DOE would host the validation test operations at one of the *aforementioned* DOE installation sites if the decision is to proceed with the Proposed Action.

1.5.1 Scoping Process

To encourage public involvement in the decision-making process, the Air Force began the scoping process by publishing an NOI to prepare an EIS in the *Federal Register* on March 13, 1992 (Appendix B). Notification of public scoping meetings was published in local newspapers and announced on local radio stations. Mailers were also sent to known interested parties.

The scoping period for this EIS began on March 13, 1992. Four public meetings were held during the scoping period to solicit comments and concerns from the general public: at Las Vegas, Nevada, on April 7, 1992; at Idaho Falls, Idaho, on April 9, 1992; at St. George, Utah, on April 16, 1992; and at Salt Lake City, Utah, on April 22, 1992. Representatives of the Air Force presented an overview of the meeting's objectives, agenda, and procedures, and described the process and purpose for the development of the SNTP program EIS.

In addition to verbal comments, many written comments were received during the scoping period. These comments, as well as NEPA requirements and information from previous Air Force experience with similar programs,

were used to determine the scope of analyses to accomplish this EIS. Copies of this EIS have been mailed to the organizations and individuals listed in Appendix C.

1.5.2 Public Comment Process

A Notice of Availability (NOA) was published in the *Federal Register* on August 22, 1992, announcing that the DEIS was available for public review and comment. Copies of the DEIS were made available for review in local libraries and provided to those requesting copies. At four public hearings held from September 8, 1992, through September 17, 1992 (at Las Vegas, Nevada; St. George, Utah; Salt Lake City, Utah; and Idaho Falls, Idaho), the Air Force presented the findings of the DEIS and invited public comments. All comments were reviewed and addressed, as applicable, and have been included in their entirety in this document. Chapter 9, Public Comments and Responses, more thoroughly describes the comment and response process.

1.6 CHANGES FROM THE DEIS TO THE FEIS

The text of this EIS has been revised, where appropriate, to reflect concerns expressed in public comments. These changes range from typographical corrections to amendments of impact analysis. The major text revisions to the DEIS are:

- Additional discussion of Purpose and Need (Sections 1.2 and 1.3) is provided

- Additional details on the description of the Proposed Action are provided (Section 2.0)

- Analysis of roads accessing the SMTS (traffic, biological resources) is added (Sections 4.4.1 and 4.7.1)

- The potential for impacts from the SNTP program and the Yucca Mountain (Nevada) Waste Repository site characterization process is discussed (Sections 4.3.1 and 4.4.1.1)

- Clarification of radioactive waste classification is provided (Section 3.5). Additional information on hazardous and radioactive wastes is provided for both NTS and INEL (Sections 4.5.1 and 4.5.2)

- Additional information on potential DOE actions regarding environmental restoration of DOE facilities, revisions to DOE waste management policies and procedures, and consolidation (reconfiguration) of the U.S. nuclear weapons production

facilities and the potential for cumulative impacts for hazardous waste management is provided (Sections 2.7, 4.5.1.4, and 4.5.2.4)

- Additional discussion of potential Native American interests is provided (Sections 3.8.1, 3.8.2, 4.8.1, and 4.8.2)
- Text is revised to incorporate the results of a recent study that no transuranic (TRU) waste would be generated (Sections 3.5 and 4.5)
- Additional discussion on seismic and volcanic conditions at NTS and INEL is provided (Sections 3.9 and 4.9)
- Quantities of cryogenics are shown for the total validation test program rather than for a single test (Section 2.3)
- The Health and Safety discussions (Sections 3.12, 4.12, and Appendix E) are modified to enhance clarity, including minor modifications to some analyses to make them more consistent.

Other lesser discussions are also incorporated in the text or included in the responses to the comments in Chapter 9.

Chapter 9 discusses the comments received from the public review process for the Draft EIS. A number of these comments requested additional details of design, analysis, and specific results, particularly in context of radioactive releases, accident scenarios, and public health and safety. Some of these details were provided where appropriate, but many of these details are more applicable to a DOE-required Safety Analysis Report (SAR) process, which would be performed subsequent to this environmental analysis. The environmental analysis was based on conservative assumptions (i.e., resulting in more severe impacts); the SAR studies would include more detailed studies, based on less conservative, more realistic assumptions. As a result, the SAR process is expected to predict impacts less severe than those presented in the EIS. If in fact the SAR process identifies greater impacts, additional environmental analysis would be required.

1.7 ORGANIZATION OF THE EIS

Chapter 1 of this EIS presents a brief history of the program, the need for and purpose of the action, information relating to the environmental impact analysis process, and a list of federal permits, licenses, and entitlements potentially required for SNTP technology development activities. Chapter 2 presents a description of the PBR propulsion system, the Proposed Action, the two siting alternatives, the No-Action Alternative, and a brief discussion of those alternatives evaluated early in the process but later eliminated from consideration. Chapter 3 describes the affected environment at the two

alternative sites, including discussions on the regional environments of NTS and INEL. Chapter 4 assesses the potential environmental consequences of the Proposed Action at each alternative site and discusses measures that would be taken to minimize impacts at affected installations. Agencies that were consulted while preparing this EIS are identified in Chapter 5, and the names of EIS authors and contributors, and complete reference citations are in Chapters 6 and 7, respectively. Chapter 8 contains a topic index, and Chapter 9 presents the public comments to the DEIS and responses to those comments. Numerous appendices provide a variety of supporting data and documents.

1.8 RELATED ENVIRONMENTAL DOCUMENTS

A declassified EIS that was prepared for an advanced technology program was used, in part, in the preparation of this EIS. Copies may be obtained from the U.S. Department of Commerce, National Technical Information Service:

National Technical Information Service
Springfield, Virginia 22161
(703) 487-4600

Document No. AD/A 248408 (EIS)
Document No. AD/A 248409 (Addendum to the EIS)

1.9 RELEVANT FEDERAL PERMITS, LICENSES, AND ENTITLEMENTS

Federal permits, licenses, and entitlements that may be required are presented in Table 1.9-1.

Table 1.9-1. Federal Permits, Licenses, and Entitlements Potentially Required for SNTP Technology Development Activities

Federal Permit, License, or Entitlement	Typical Activity, Facility, or Category of Persons Required to Obtain the Federal Permit, License, or Entitlement	Regulatory Agency	Authority
Title V permit under the Clean Air Act (CAA), as amended by the 1990 Clean Air Act Amendments	Any major source (source that emits more than 100 tons/year of criteria pollutant in nonattainment area for that pollutant or is otherwise defined in Title I of CAA as a major source); affected sources as defined in Title IV of CAA; sources subject to Section 111 regarding New Source Performance Standards; sources of air toxics regulated under Section 112 of CAA; sources required to have new source or modification permits under Parts C or D of Title I of CAA; and other sources designated by EPA regulations	U.S. Environmental Protection Agency (EPA); applicable state Air Pollution Control District if state has EPA-approved air quality control program	Title V of CAA
National Pollutant Discharge Elimination System permit	Discharge of pollutant from any point source into waters of the United States	U.S. EPA; State Water Quality Control Board	Section 402 of Federal Water Pollution Act, 33 USC §1342
EPA identification number	Generators or transporters (off-site transport) of hazardous waste	U.S. EPA	40 CFR Part 262.10 (generators); 40 CFR Part 263, Subpart B (transporters)
Antiquities permit	Excavation and/or removal of archaeological resources from public lands or Indian lands and carrying out activities associated with such excavation and/or removal	U.S. Dept. of the Interior, National Park Service	Archaeological Resource Protection Act of 1979, 16 USC §470cc
Endangered Species Act §10A permit	Taking endangered or threatened wildlife species; engaging in certain commercial trade of endangered or threatened plants or removing such plants on property subject to federal jurisdiction	U.S. Dept. of Interior, Fish & Wildlife Service	Section 10A of Endangered Species Act, 16 USC §1539; 50 CFR Part 17, Subparts C,D,F, & G

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter discusses the Proposed Action, two alternative sites for implementing the Proposed Action, and the No-Action Alternative. A conceptual Particle Bed Reactor (PBR) system is described, as are the proposed test program, test facilities, and decontamination and decommissioning activities at the end of the program. A comparison of environmental impacts of the proposed action and alternatives is provided in table form. Alternatives eliminated from further consideration are addressed.

2.1 PROJECT OVERVIEW

The Air Force proposes to develop the technology and demonstrate the feasibility of a high-temperature PBR propulsion system that could be operated outside the atmosphere in space as an advanced upper stage nuclear rocket engine or an orbital transfer vehicle. A conceptual propulsion system is shown in Figure 2.1-1. The general concept of the nuclear propulsion system involves use of the PBR to heat cryogenic hydrogen propellant to very high temperature gaseous hydrogen. The hot hydrogen is exhausted through a nozzle to produce thrust.

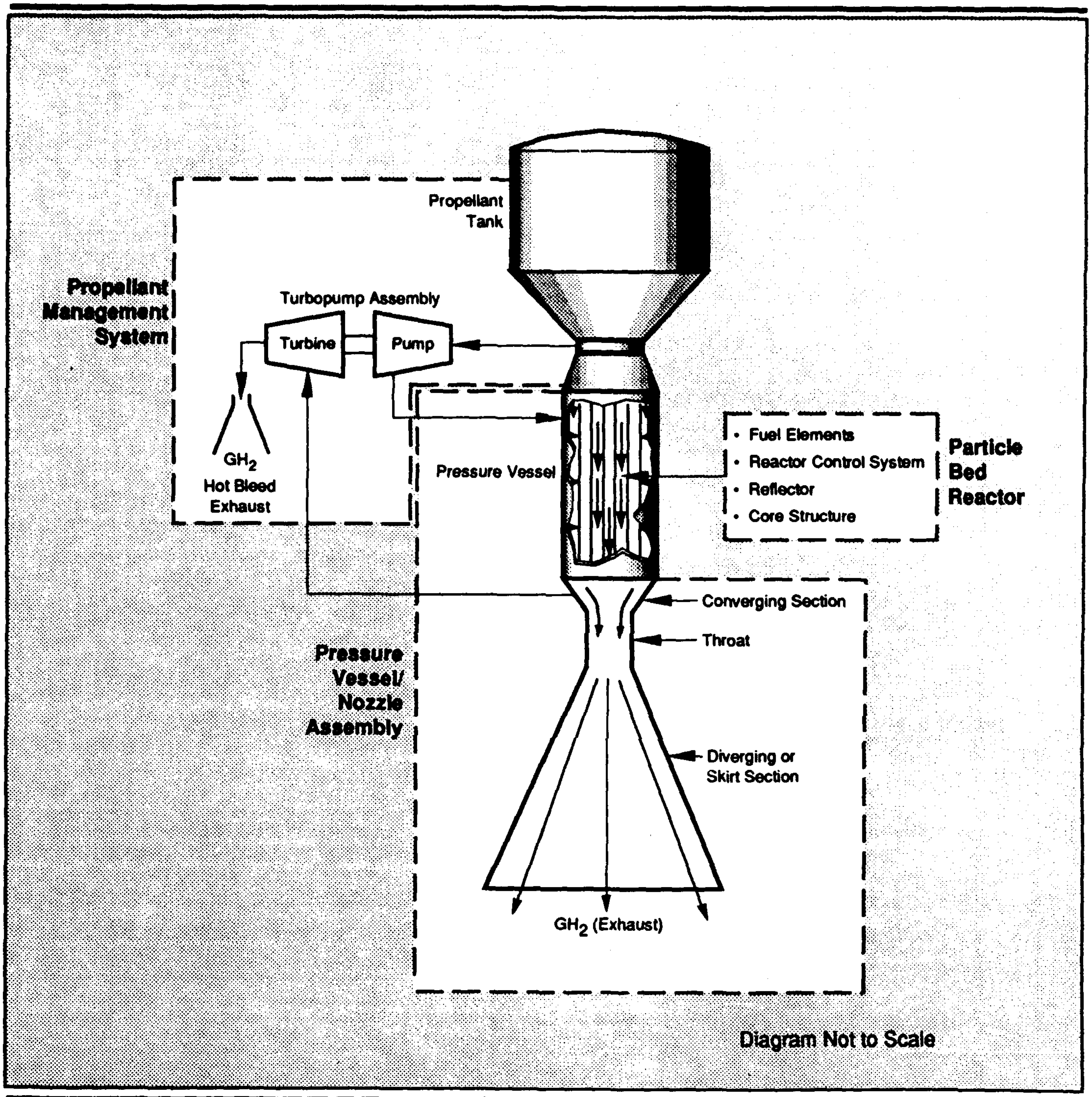
The Proposed Action for this propulsion technology development and validation program consists principally of (1) development and validation of the PBR propulsion technology, and (2) construction and operation of necessary testing facilities.

Major technological goals of the Space Nuclear Thermal Propulsion (SNTP) program include the achievement and control of predicted nuclear power levels; the development of materials that can withstand the extremely high operating temperatures and hydrogen flow environments; and the reliable control of cryogenic and high temperature hydrogen propellant.

2.2 DESCRIPTION OF PROPOSED ACTION

Three decisions are to be made regarding the program: (1) whether to continue the SNTP program through the development of nuclear thermal propulsion technology; (2) whether to construct and operate a PBR validation test facility; and (3) where to locate the PBR validation test facility if the program is to continue. Information related to each of these decisions is described in this chapter and is organized in the following manner:

- Whether to continue with the technology. The principal PBR subsystems are described and elements of the test program are detailed



Conceptual PBR Propulsion System

Figure 2.1-1

- **Whether to construct and operate a PBR validation test facility.** The components of the sub-scale and full-scale test facilities are described in this section, and requirements typical for both construction and renovation for the facilities are detailed

- **Where to locate the PBR validation test facility.** Sites at two Department of Energy (DOE) installations are described: the Saddle Mountain Test Station (SMTS) site at Nevada Test Site (NTS), which would require new construction; and the Contained Test Facility (CTF) site at Idaho National Engineering Laboratory (INEL), which would require renovation of existing facilities and new construction.

The principal technology issues and goals related to the propulsion technology are (1) verification of the PBR concept; (2) design and fabrication of high temperature fuel particles; (3) design and fabrication of the concentric porous cylinders to contain the fuel particles (frits) that must withstand high temperatures and resist adverse reactions with either the fuel particles or the flowing coolant (hot frits) as well as distribute coolant and match power to flow (cold frits); (4) design and fabrication of the engine nozzle to withstand the high temperatures and to resist adverse reactions with the hydrogen gas; and (5) design of a reliable reactor control system.

2.2.1 PBR Propulsion System Description

This section describes a conceptual design of a nuclear thermal propulsion system, based on PBR technology. The final PBR propulsion system design would evolve as development occurs and can be expected to incorporate features, parameters, and characteristics different from the concepts presented here. The following paragraphs provide a conceptual overview of the system and basic components for illustrative purposes. The conceptual system design also serves as a basis for analyzing and identifying potential environmental consequences. While some variation is expected as the final design is developed, the environmental consequences developed in this EIS represent the bounding cases that will not be exceeded in the PBR validation testing.

Use of fuel-particle technology (see Section 2.2.1.1) in reactor design is not a new idea, and has been considered for commercial and breeder reactor applications both in the United States and abroad. A significant advantage in efficiency can be achieved by using a packed bed of fuel particles which, due to high surface-area-to-volume ratio, supports operation at high power densities while maintaining fuel temperatures at acceptable levels. This high power density implies a high thrust-to-weight capability, which is preferable for Air Force operations in space. As a result, the PBR concept has received

significant attention in the technical community as a means of improving performance in orbital transfer vehicles and deep-space propulsion systems.

The principal components of a conceptual PBR propulsion system are the particle bed reactor, the pressure vessel/nozzle assembly, and the propellant management system (see Figure 2.1-1). With the exception of the reactor, most of the major components are typical of any rocket engine system and are not unique to PBR designs. Further discussion of the principal components is presented below.

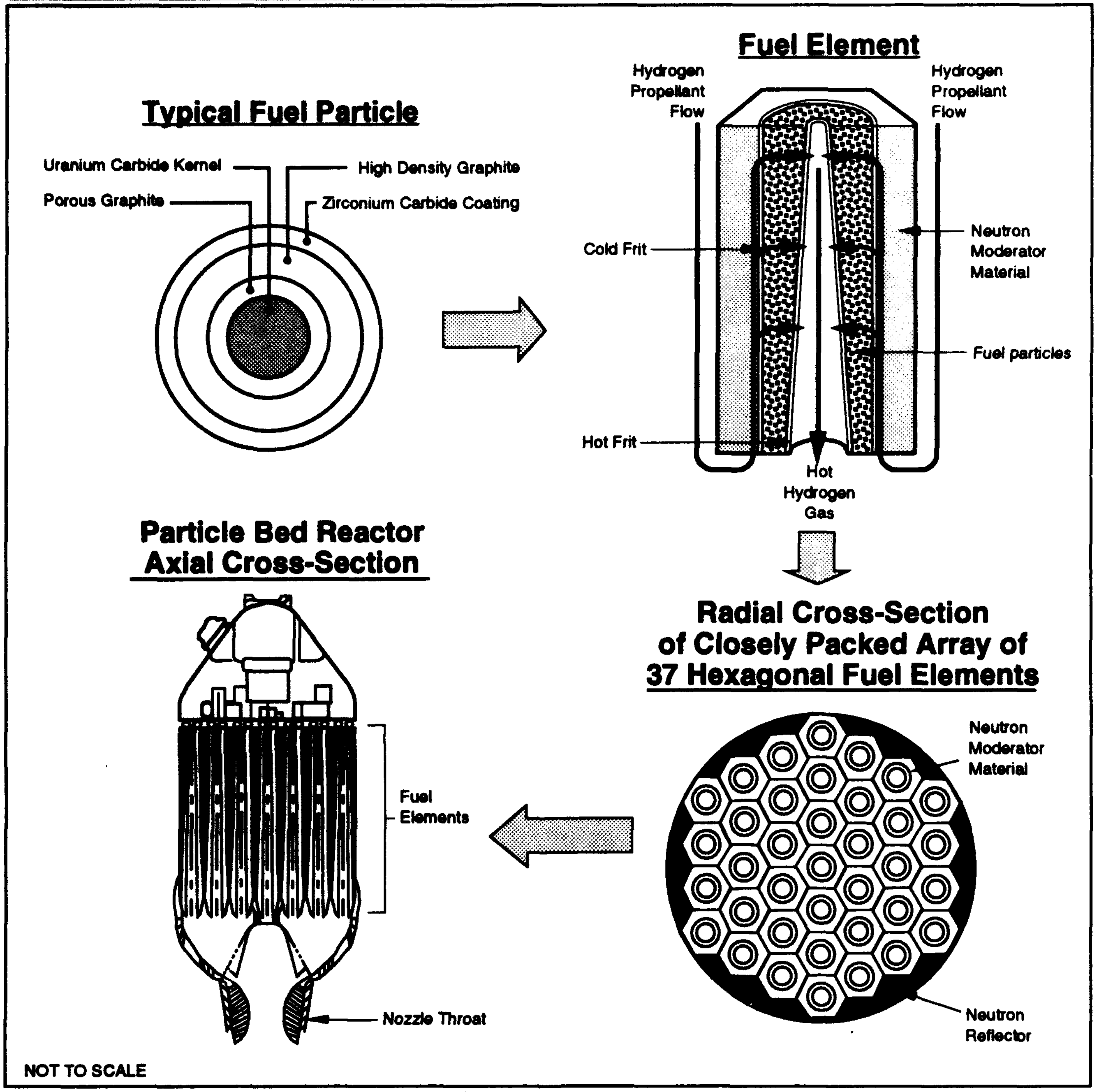
2.2.1.1 **Particle Bed Reactor.** The PBR would use spherical fuel particles, each approximately 0.5 millimeters in diameter. A typical fuel element could contain many millions of these fuel particles. A typical particle (Figure 2.2-1) contains a kernel of fully enriched uranium-235 (U-235) surrounded by a porous graphite buffer layer. Next is a high-density graphite layer which is surrounded by a final layer of zirconium carbide. These coated multiple layers provide containment of fission products and prevent the heated hydrogen from damaging kernel material. Prior to implementation of the PBR test program, sufficient tests, which have already been performed or are planned, will be completed to ensure proper particle integrity and quality assurance. Other similar particle designs that may have high performance characteristics (e.g., higher temperature capability kernel or improved coating) are potential candidates for fuel material development; however, the type and quantity of nuclear fuel material used would remain the same.

Each hexagonal fuel element (see Figure 2.2-1) includes neutron moderator material, a set of concentric frits and the fuel particles. The concentric frits are devices that structurally support the fuel particles while allowing hydrogen to flow through the material and cool the fuel particles. Flow paths through an element are illustrated in Figure 2.2-1. The entire fuel element assembly would be surrounded by a neutron reflector such as graphite or beryllium to enhance reactor performance.

The PBR configuration under consideration consists of a closely packed array of hexagonal-shaped fuel elements, surrounded by neutron moderating and reflector materials and reactor control devices (safety rods and control drums) (Figure 2.2-2). Use of an array of hexagonal fuel elements allows the option of a modular design, where the number of elements used (e.g., 19, 37, or 61) could be tailored to produce the desired thrust.

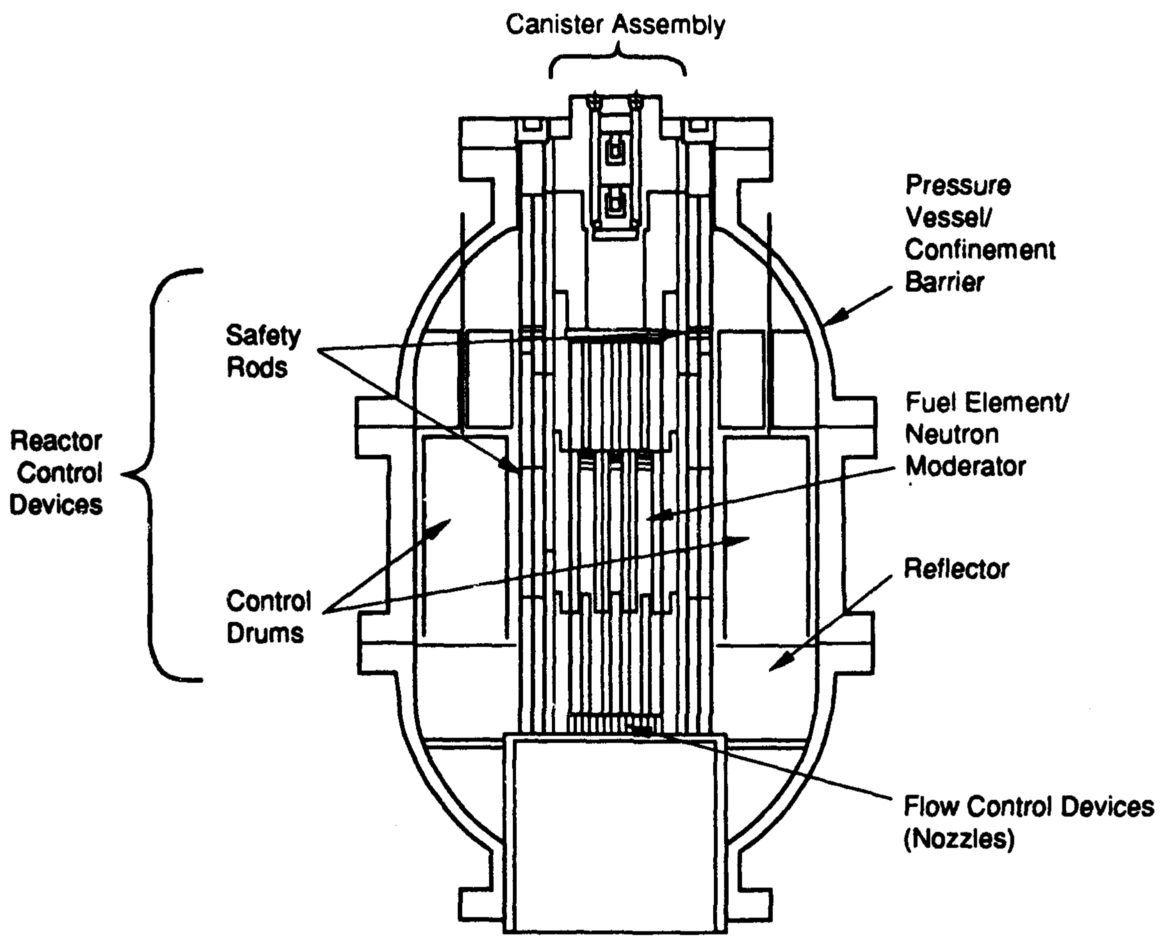
Cryogenic hydrogen (35 to 50 Kelvin [K] or -238° to -223° Centigrade [C]) coolant flows into the reactor. As it cools the fuel, the hydrogen heats up and enters the nozzle assembly where it expands, producing thrust.

2.2.1.2 **Pressure Vessel/Nozzle Assembly.** The pressure vessel/nozzle assembly (see Figure 2.1-1) would perform the following two tasks:



Particle Bed Reactor Description

Figure 2.2-1



PIPET Reactor Axial Cross-Section

Figure 2.2-2

- Provide pressure containment and structural support for the PBR
- Collect hydrogen gas from each reactor fuel element and accelerate the gas through the throat section of the nozzle to generate thrust.

2.2.1.3 **Propellant Management System.** The purpose of the propellant management system (see Figure 2.1-1) is to provide controlled flow and pressure to the reactor and any ancillary subsystems. The system also contains provisions for tank pressurization and chilldown/conditioning of cryogenic fluid paths. During operation, cryogenic hydrogen exits the propellant tank and enters the pump section of the turbopump assembly. After exiting the pump, the propellant is delivered to the reactor where it is heated to the desired temperature. A small portion of the propellant is bled off to power the turbopump assembly and the balance is subsequently expanded through the nozzle.

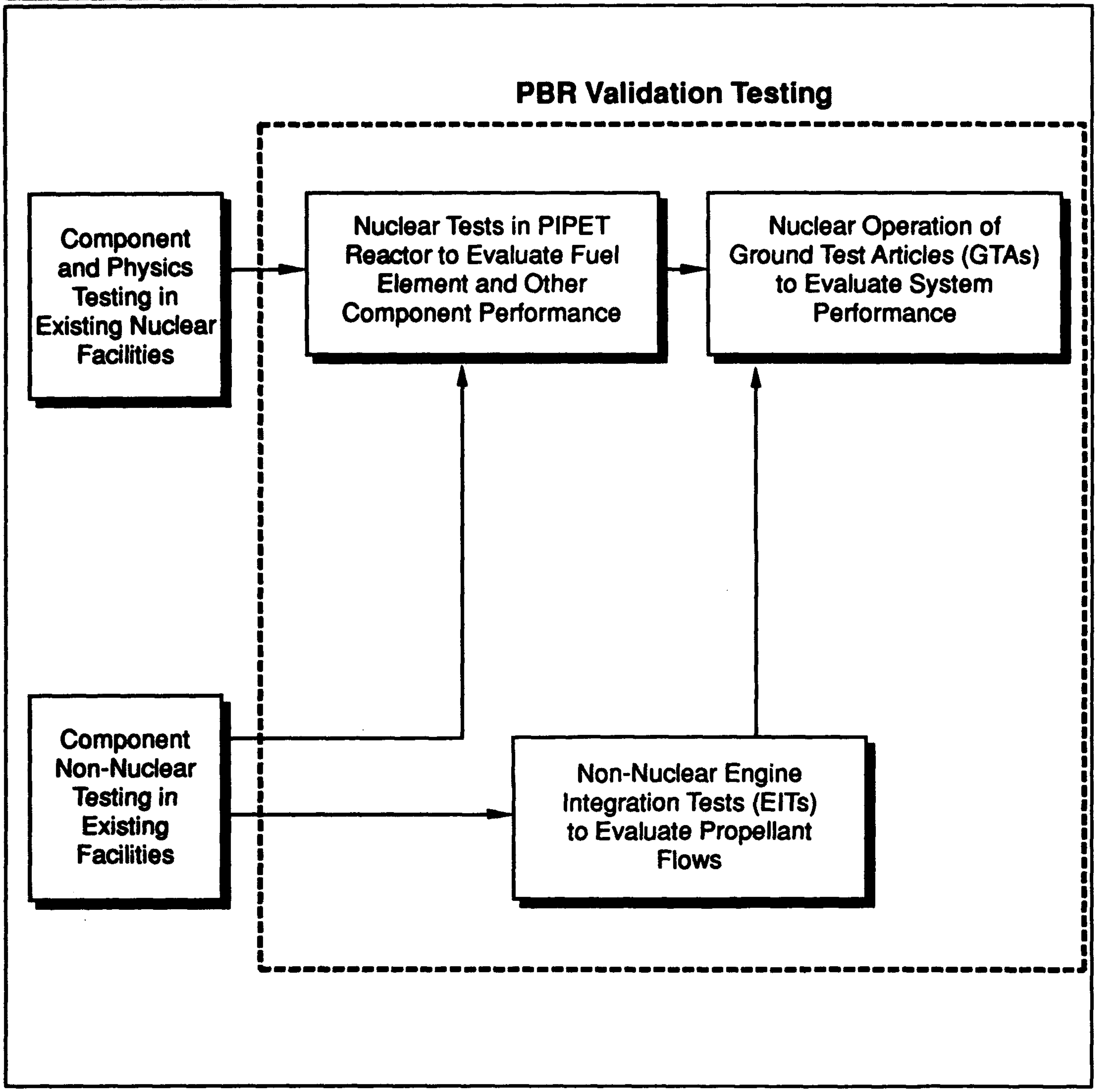
2.2.2 Test Program

This section describes the validation testing of the PBR propulsion technology. The proposed testing would demonstrate the technology through a series of tests over a 5- to 10-year period leading to the validation of the PBR concept. As shown in Figure 2.2-3, the tests are sequenced to commence with fuel element testing and culminate in complete system testing. Specifically, this test series includes the PBR Integral Performance Element Tests (PIPETs) and the Engine Integration Tests (EITs) as well as tests of Ground Test Articles (GTAs).

2.2.2.1 **Planned Test Operation.** Standard operating procedures would be prepared for each test. Each test series would be carefully planned to include written procedures and formal review and approval. Procedures would also be developed for material receipt and storage, preliminary assembly, post-irradiation component disassembly, inspection of major components, and associated transportation requirements. Development of operating procedures would be based upon preceding program results; supporting experimentation; validated analysis; and safety, environmental, and procedural requirements.

A remote inspection and maintenance system would permit timely evaluation of the test reactors in a high-radiation environment. The capability of conducting multiple operations using the same reactor core assembly would depend on the ability of this system to verify the integrity of the fuel elements prior to commencing each reactor operation.

Designs of the systems involved in test operations are only conceptual at this time. The detailed design process would follow completion of this EIS, if the decision is to proceed with the program. Each test sequence would



EXPLANATION

PBR Validation Testing Analyzed in this EIS

Testing Sequence

Figure 2.2-3

undergo a comprehensive safety analysis as described in Chapter 4. The forthcoming Safety Analysis Reports (SARs) would include performance specifications and appropriate failure mode analysis associated with the detailed designs. Analysis of safety would be conducted in accordance with DOE procedures for the SAR process (current guidance provided in DOE Order 5480.23).

2.2.2.2 Fuel Element Performance Tests in PIPET. The PIPET would be the first self-sustained, power-producing PBR test (see Figure 2.2-2 for a cross section of the PIPET reactor). This test would demonstrate the reactor fuel element operation typical of reactor conditions (power densities, pressures, temperatures, flow rates, and power durations) to support envisioned missions. Data would be obtained on the fuel element, materials, and thermal-hydraulic performance.

A maximum of 50 full-power-equivalent PIPETs (including five mini-GTAs described in Section 2.2.2.4) would be performed over the 5-10 year program schedule, and up to 10 PIPET cores would be used. The maximum number of PIPETs per year would be 10 full-power-equivalent tests involving two PIPET cores (five full-power-equivalent tests per core). Thus, while more than 50 PIPET operations may be conducted at or less than full power, the total impact would not exceed that of 50 full-power tests.

The PIPETs would demonstrate the performance, operability, and reliability of fuel elements developed for the SNTP program. Although this testing would make use of fuel element component verification data from tests in existing facilities to help define the design envelope, such information would not be based on exact simulation of engine system conditions. Due to the unique conditions associated with SNTP reactor designs, the PIPETs would be the first opportunity to validate the fuel elements. Since a large degree of uncertainty would exist regarding the actual capabilities of the fuel elements and the actual design envelope, design requirements of the PIPET Effluent Treatment System (ETS) (see Section 2.2.3.1) include a provision to handle loss of a complete core under bounding case conditions (Section 4.12.2.3) provided from accident analyses conducted by the program safety team. An outline of the preliminary SAR for PIPET is provided in Appendix D.

The PIPET fuel elements and major components could be shipped to an on-site receiving/assembly building for assembly. A second option would be to ship the assembled devices as one unit. Department of Transportation-certified containers are available for either type of shipment. Following receipt and component assembly, pre-operational inspections and testing would be required. Upon completion, the reactor components would be taken to a sub-scale test cell for installation for further pre-operational testing and test operations.

The initial PIPET assembly would consist of typical reactor elements. Supplemental low-power assist elements may also be placed in the moderator region if necessary to assure a sufficient reactivity margin. Each of the cores could be subjected to five operating cycles at a maximum power level of 550 megawatts (MW) for as long as 500 seconds per cycle, with a minimum of 7 days separating each operating cycle at power. The uranium fuel may be subjected to temperatures exceeding 3,300 K (about 3,000°C), as would the hydrogen coolants which could be heated to approximately 3,000 K (about 2,700° C). Hydrogen, noble gases, halogens, volatiles, and particulates could be present in the exhaust stream. The total inventory of fission and activation products in a PIPET reactor after a 500-second run is shown in Table E-3 in Appendix E.

Cryogenic and ambient temperature hydrogen would be mixed externally to obtain high-pressure cryogenic hydrogen, which would then be supplied to the test article. Hydrogen coolant would follow several paths through the PIPET assembly. One path would cool the fuel elements with the hydrogen exiting at high temperatures. A second path would cool auxiliary structures (e.g., safety rods, reflector, support structures) with the hydrogen exiting at significantly lower temperatures. Hydrogen would be used for immediate post-test cooling of the reactor core, followed by purging and decay heat removal using helium at moderate flow rates and temperatures.

Engine component tests in the sub-scale facility would be developmental tests to expose system components to the hot hydrogen and radiation environment. A special nozzle may be installed to tap off hot hydrogen to feed such propellant management system components as the mixer, the speed control valve, and the turbine. The PIPET radiation environment would be used to expose and evaluate critical flow or control system components.

The remote inspection and maintenance system would be used as appropriate for evaluation of the fuel elements and components between individual tests in a series as well as upon completion of a series. After the last test of a series, the PIPET canister assembly containing the fuel elements would be removed for interim storage on site and possible transport off site for further examination or disposal.

2.2.2.3 Non-Nuclear Engine Integration Tests. EITs would be designed to demonstrate proper function of the propellant management system without an operating reactor in the loop. A mock-up of the entire system would be tested using a gas generator system to produce hot hydrogen to power the turbopump for system checkout. The gas generator system would consist of a liquid oxygen/liquid hydrogen combustor, a steam/hydrogen heat exchanger, a liquid oxygen tank, a liquid hydrogen run tank, and a tank pressurizing system. Chill and purge procedures would be developed, and leak checks and functional tests performed. The EIT series would establish

confidence in the control and feed system necessary to proceed to the GTA system tests. Under current plans, the EIT series would be performed at the validation test station described in Section 2.2.3. The use of existing off-site facilities for portions of the EIT is also being evaluated.

During the EIT, liquid hydrogen at pressures of 310 to 345 kilopascals (kPa) (45 to 50 pounds per square inch [psi]) would be fed into the pump side of the turbopump assembly; the gas generator would produce hydrogen gas of approximately 2,700 K (2,400° C) which would be used to drive the turbine side of the turbopump assembly. Performance of various components at measured pressure, temperature, and flow conditions would be monitored. Waste products consisting of hydrogen and oxygen gases and steam would be vented to the atmosphere. Individual test runs would last from a few seconds to several minutes.

A maximum of 15 EITs would be performed over the 5-10 year program schedule. Up to five EITs would be performed prior to startup of GTA testing, and additional EITs would be performed as needed (not to exceed a total of 15) prior to individual GTA tests.

2.2.2.4 Ground Test Article Tests. The GTAs would be a series of up to ten reactors which gradually approach the desired performance conditions. GTA design would evolve from technical information derived during PIPET and other program testing. GTA tests would employ a single cutback nozzle configuration and, through a progressively expanding test envelope, expose the nozzle to the full performance profile values of temperature, pressure, flow rate, and nuclear radiation fields.

A maximum of 10 full-power-equivalent GTA tests, and five mini-GTA tests (the five mini-GTA tests are included in the 50 PIPETs) would be performed over the 5-10 year program schedule, and up to 10 GTA cores would be used. No more than two GTA full-power-equivalent tests would be performed in any one year (two GTA cores, each tested once). Thus, while more than 10 GTA test operations may be conducted at or less than full power, the total impact would not exceed that of 10 full-power tests.

Mini-GTA

The mini-GTAs would be sub-scale versions of the GTA. Subsequent to satisfactory operations associated with PIPETs, mini-GTAs would be subjected to tests in the same sub-scale test cell used for PIPETs.

The mini-GTA reactors would be designed to more closely represent a full-size GTA fuel element and would be operated in essentially the same way as PIPET reactors in a sub-scale facility test cell. Approximately five tests (included in the 50 PIPETs), each of 500-second duration at a maximum power level of 550 MW, would be performed on each of the mini-GTAs.

The test matrix could potentially generate a fission product inventory in the mini-GTA reactor similar to that generated in the PIPET cores. The total inventory for a 500-second run is shown in Table E-3 in Appendix E.

Full-Scale GTA

The full-scale GTA test series would demonstrate a complete PBR operation with feed and control hardware and a full complement of instrumentation. Multiple tests would be performed on each of the full-scale GTAs. The tests would build up from critical (zero power), to low power, to operational power and temperatures. These tests would demonstrate controllability and stability at full power and rapid start-up and shutdown under computer control over a simulated full mission profile.

The test series would progress from a cold flow test in which the hydrogen gas is passed through the reactor while the core is held in a subcritical condition, to tests in which the reactor is held critical at full power levels. Each test would be only a few minutes in duration. The maximum time at full reactor power for any individual core assembly of the GTA test series would be approximately 1,000 seconds. The test matrix associated with each of these reactor cores could potentially generate a fission product inventory (described in Chapter 4) resulting from a single 1,000-second operation at a maximum power level of 2.0 gigawatts (2 million megajoules) (see Table E-4 in Appendix E). The uranium fuel may be subjected to extreme temperatures of approximately 3,300 K (about 3,000° C), as would the hydrogen coolants, which could be heated to approximately 3,000 K (about 2,700° C).

The GTA conceptual design includes a turbopump assembly which supplies cryogenic hydrogen to the reactor at the design operating pressures and temperatures. Cryogenic hydrogen for the full-scale GTA test series would be supplied from a large liquid hydrogen tank and pressurized using a turbopump assembly included as a part of the test article. An alternate design would employ a facility pump to supply cryogenic hydrogen from low-pressure storage tanks. The supply system selected would depend upon design compromises.

2.2.2.5 Decontamination and Decommissioning. The testing facility would be developed to support PBR technology development activities. However, the same facility may be used to support related research and development of nuclear propulsion systems for other applications, following appropriate safety and environmental analysis and documentation.

In the event that a period of inactivity should become necessary, the facility would be preserved so that reactivation could be accomplished with a minimum of expense and in a timely manner. All readily accessible areas

would be decontaminated to a level allowing general access in accordance with appropriate safety requirements (e.g. DOE Order 5400.5).

Upon completion of usable service, the facility would be decontaminated and the area restored to as nearly an original state as deemed practical by the cognizant authorities at the time. DOE Order 6430.1A (General Design Criteria) would be applied to the design activities to enhance eventual decommissioning activities.

A decontamination and decommissioning plan would be prepared for the PBR validation test facility prior to the acceptance of any U-235. The plan would be consistent with DOE Order 5820.2A Chapter V, Decommissioning of Radioactively Contaminated Facilities. The decontamination and decommissioning plan would be updated at the completion of testing at the sub-scale level and at the completion of each major test program, but no less frequently than every 5 years.

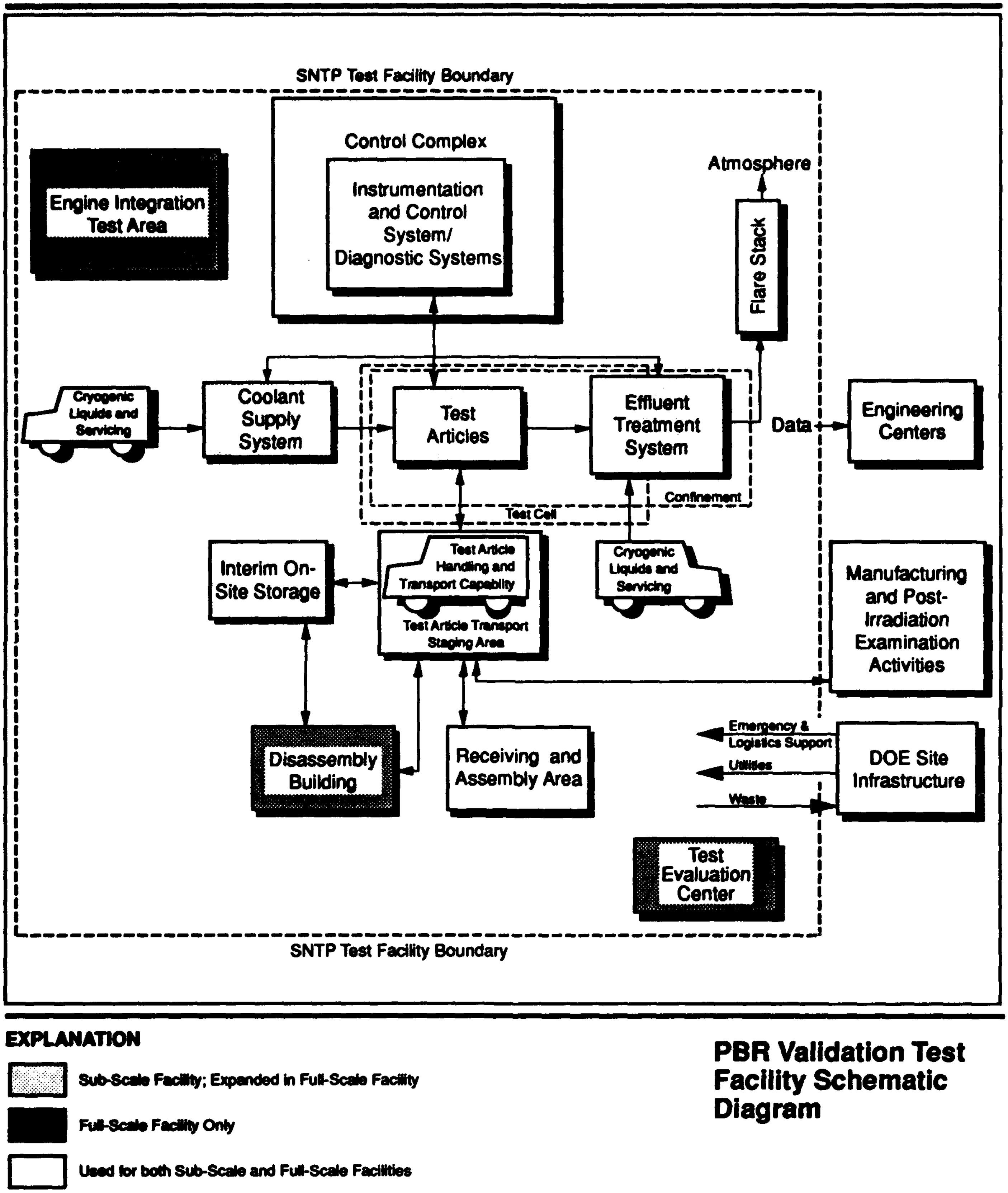
2.2.3 PBR Validation Test Facilities

Demonstration of the PBR propulsion technology requires testing of reactor, nozzle, and propellent management system assemblies, and system integration tests. Because no facility exists that fully meets testing requirements, construction of a new test facility or extensive modification of an existing facility is required. Alternative locations for the test facility were considered and a summary of findings of the Site Narrowing Report is provided as Appendix F. One location at NTS and one location at INEL have been identified as reasonable alternatives for the proposed test facility.

Construction/modification of facilities would be phased to provide a sub-scale facility to accommodate the initial testing. The sub-scale facility would include a single test cell for the PIPET and mini-GTA test reactors as well as the supporting infrastructure. PIPETs would include some tests to characterize failure mechanisms and margins, in order to resolve safety, performance, and environmental issues accurately.

If the sub-scale testing proves successful, the sub-scale facility would be expanded to provide a full-scale facility necessary to complete the GTA testing. The full-scale test facility would be designed to accommodate a GTA test reactor with a capacity of 2,000 MW. It is estimated that up to 10 GTA test series would be run. Safeguards and physical security would be provided in accordance with the DOE 5600 series of orders.

The environmental consequences of both the sub-scale and full-scale facilities have been included in this document. Refer to Figure 2.2-4 for a schematic diagram of the PBR validation test facility.



PBR Validation Test Facility Schematic Diagram

Figure 2.2-4

2.2.3.1 Sub-Scale Facility. As shown in Figure 2.2-4, the sub-scale facility would include a control complex including the instrumentation and control and diagnostic systems; a receiving and assembly area; a test cell; an interim on-site storage area; a test article transport staging area; a confinement system; and the process fluids systems, which consist of both the coolant supply system (CSS) and the ETS. The major features of the sub-scale facility are discussed in detail below.

Control Complex

The control complex would be a shielded reinforced concrete building from which access to the test facility, activities involving the test cell, and a system to provide video surveillance over the entire test facility would be controlled. The complex would contain all control consoles associated with the test facility during PIPET, EIT, and GTA operational testing.

Habitability systems would be provided to ensure a safe environment for operations personnel to achieve safe reactor shutdown, decay heat removal, and post-reactor shutdown monitoring during normal operations. Also, should it be necessary after an accident, these systems would provide the operations personnel with a safe environment in the control complex until they could leave safely.

The fire protection system for the control complex would be designed in accordance with DOE/EP-0108, Standard for Fire Protection of DOE Electronic Computer/Data Processing Systems; Group 2 Ordinary Hazard Occupancy classification; and National Fire Protection Association Standards. These codes and regulations specify all aspects of design which affect fire safety at the test facility.

Instrumentation/Control and Diagnostic Systems

Instrumentation and Control System. The instrumentation and control system would provide the required safety and control functions for all operations at the test facility. The system would consist of sensors, electronics, actuators, and displays necessary for remote control of all functions associated with the test systems. In addition, the instrumentation and control system would provide visual indication of critical system parameters and process status to assure safe operation during all phases of the experimental programs.

Diagnostic System. The diagnostic system would include data acquisition equipment normally associated with an experimental activity. This instrumentation is intended to provide the operating staff with the ability to analyze the performance of the experimental package and is separate from that required to ensure safe operations.

To prevent an accident from inflicting personal injury or equipment damage, some of the design criteria are as follows:

- Locate the control complex in an area so that in emergencies all critical equipment can be operated safely
- Provide for an automatic shutdown that would be initiated if a critical out-of-range condition is detected
- Ensure that remotely controlled components/equipment would move to their safest position (e.g., by spring action) if operational power is lost.

Receiving and Assembly Area

An area would be provided to test the major components of the reactor at the sub-scale level, to assemble, and to conduct non-nuclear testing of the assembled components prior to their being transported to the test cell. Sufficient space would be provided for the normal administrative requirements associated with these activities.

Test Cell

The sub-scale facility would include a test cell to accommodate the initial PBR validation tests. Radiation shielding would be provided by thick reinforced concrete walls. The test cell would be designed to accommodate the major components of the reactor and include sufficient penetrations to provide fluids, power, and instrumentation necessary for reactor operations as well as capability to handle and store irradiated material. The test cell design would include appropriate fire suppression systems.

Interim On-Site Storage

Additional capability would be provided to accommodate interim storage of irradiated fuel and reactor components pending further evaluation. This capability would accommodate storage of multiple cores, including a pre-test core, a core currently used in testing, and a post-test core. Such storage would be sufficiently designed and sited to assure the stored articles could not be affected by site operations or accidents.

Test Article Transport Staging Area

Equipment and space would be provided to allow for the operations required to prepare and package for shipment the irradiated fuel and reactor components for further post-irradiation examination activities.

Confinement System

The confinement system would include the necessary equipment and physical barriers to ensure that fission products released to the environment are not in excess of the design fission product release rate. The confinement barrier for PIPETs would enclose the reactor and portions of the ETS. Single failure criteria as defined in Title 10, Code of Federal Regulations (CFR) Part 50(A) may require additional structures which would be designed to accommodate, with sufficient safe margin, calculated pressure, temperature, and energy loading conditions resulting from normal operations and credible accidents.

Process Fluid Systems

Each type of PBR test would require differing amounts of cryogenic fluids and compressed gases. For a PIPET, approximately 240,000 gallons of liquid hydrogen (LH_2) would be necessary to provide coolant to the reactor fuel and to cool the effluent prior to its entry into the ETS cryogenic adsorbers; 270,000 gallons of liquid nitrogen (LN_2) to support the ETS gas-to-gas cooler; and 7,660,000 cubic feet of ambient pressure gaseous helium (GHe) for system purging, vessel pressurization, and decay heat removal. Materials required for GTA- and EIT-related activities are discussed in Section 2.2.3.2.

The process fluid systems for the sub- and full-scale test facilities would consist of two major subsystems: (1) the CSS and (2) the ETS.

Coolant Supply System (CSS). The CSS would be composed of the hydrogen storage system, the helium storage system, and the pipes and valves for coolant distribution. Siting of storage vessels would be in accordance with Air Force Regulation (AFR) 127-100, Explosive Safety Standards. These subsystems are described below.

Hydrogen Storage System. Three types of hydrogen storage vessels would be required at the test facility: low-pressure LH_2 storage, high pressure cryogenic hydrogen storage, and high-pressure ambient temperature hydrogen storage. The low-pressure LH_2 storage would provide bulk quantities of hydrogen for all test station activities. The liquid and ambient temperature hydrogen would be mixed at high pressure to provide a variable temperature hydrogen flow to the facility test cells during test operations. Gaseous hydrogen (GH_2) would also be used as a pressurant for the high-pressure cryogenic hydrogen storage vessels.

Reactor safety concerns would require that high-pressure cryogenic hydrogen be supplied to the test cell by two or more independent systems. Thus the total storage volume requirement would be equally divided among a number of storage vessels. During normal test operation, each

independent system would supply one-half of the hydrogen flow required by the fuel elements; however, the pipes and valves associated with each independent supply system would be sized to accommodate the total flow required by the reactor fuel. If a failure occurs in one system, the other system would increase flow to the reactor fuel and the test would be terminated. Operational limits would be placed on the high-pressure cryogenic hydrogen level and the ambient temperature gas storage pressure to ensure that each of the independent systems retains sufficient hydrogen to provide an orderly reactor shutdown, including that portion of the decay heat removal operation which uses hydrogen.

Each of these independent hydrogen supply systems would be protected from projectiles that may result from the rupture of pressure vessels, piping, or the detonation/deflagration potentially associated with a failure in the other systems. This protection would be provided by placing shrapnel barriers in appropriate locations to isolate storage vessels associated with one independent supply system from the vessels of the other. Additional protection for the independent hydrogen supply systems would be provided by placing shrapnel barriers in appropriate locations to isolate the high-pressure hydrogen storage vessels from the other storage vessels (e.g., oxygen) located at the test station.

Helium Storage System. Helium would be used at the test facility for purging storage vessels, pipes, and test articles; for pressurizing certain fluid storage vessels; and for removing decay heat from the test cell subsequent to testing operations. Helium would be stored as a gas at high pressure and ambient temperature. The helium storage vessels would be adequately protected from projectiles by placing shrapnel barriers in appropriate locations to isolate them from the hydrogen and other storage vessels. The high pressure, ambient temperature helium storage for the sub-scale facility requires a volume of 4,700 cubic feet at a storage pressure of 19 megapascals (MPa) (2,800 psi), and a temperature of 250-320 K (23-47° C).

Coolant Distribution System. The fluids distribution system (pipes and valves) would supply hydrogen and helium to various locations at the test facility in appropriate quantities to support test and operational activities. Auxiliary equipment required by the fluids distribution system would include vaporizers to maintain pressure on the bulk LH_2 storage vessels during transfer operations; facility pumps and vaporizers to enable filling the high pressure ambient temperature hydrogen storage vessels; filters at the fill stations and test cell to maintain fluid cleanliness; instrumentation to monitor conditions in the storage vessels and distribution systems; and mixers to deliver variable temperature hydrogen to the test cell. The pipes, valves, and associated components of the fluids distribution system would be designed to operate in the range of 690 kPa (100 psi) at 20 K (-253° C)

for low-pressure LH_2 lines, to 41 MPa (6,000 psi) at 320 K (47° C) for GH_2 lines.

Isolation valves would be located at the inlets and outlets of all pressure vessels. Remotely actuated or pressure regulating valves would be used to control the pressure in the storage vessels. Pressure relief devices would be incorporated into the design of the isolation system to avoid over-pressuring the storage vessels. Pressure relief devices would also be incorporated into the design of any feed line that may be isolated when carrying cryogenic hydrogen.

Large-quantity releases of hydrogen would be vented to a coolant flare stack. Operations that are expected to release large quantities of hydrogen are cooldown of the liquid hydrogen storage vessels, fill of hydrogen storage vessels, and post-operational purge of hydrogen feed lines. The flare system would be designed and sized as appropriate for the range of expected flow conditions resulting from these operations.

Effluent Treatment System (ETS). There are three major reasons for incorporating an ETS into the test facility. First, one of the goals of PIPET is to validate design margins. The potential for releasing a larger quantity of fission products increases as the operating parameters approach these limits. The emissions of radionuclides into the ambient air from DOE facilities are regulated by the National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61 Sub-Part H), which specifies that the emissions shall not exceed an amount that would cause any member of the public to receive in any year an effective dose equivalent of 10 milliroentgen-equivalent-man (mrem) per year. While the NESHAP may allow a member of the public to receive a dose of 10 mrem in a year, the SNTP program would be committed to a design goal of 2 mrem per year, or 20 percent of the allowable regulatory limit. Second, because the SNTP program is a developmental program, there would be some uncertainty in the actual composition of the effluent. An ETS would ensure that the emissions from planned activities would remain within the program goals under all postulated routine operating scenarios. Third, it is a national policy to reduce radioactive discharges to a level that is as low as reasonably achievable (ALARA). The ETS would be designed to reduce releases of noble gases (primarily xenon and krypton), halogens (primarily iodine), volatile elements, and other fission products in the form of particulates[1].

The ETS would be designed to accomplish the following objectives: (1) ensure that radioactive material entering the ETS remains in a subcritical geometry; (2) cool the test article effluent to temperatures acceptable for normal engineering materials used in gas treatment systems; (3) remove

[1] Appendix E shows the total expected fission product inventory of the testing activities. Chapter 4, Section 4.12, describes the expected radiological effects as a result of release from the ETS.

particulates and debris from the effluent stream; (4) remove halogens, noble gases, and vapor phase contaminants from the effluent stream; and (5) flare the resulting hydrogen gas to the atmosphere. The effluent would pass through the ETS in 5-10 seconds, although the noble gases would be removed and retained for several days to allow decay of the short-lived isotopes.

The ETS would be designed in such a manner that during test operations and under accident conditions (including consideration of any impacts associated with the accumulation of radiological material in the ETS) the releases are reduced to limits derived from exposure limits for workers and the public given existing guides, regulations, and standards. Further, it is the policy of the program that the releases be reduced below these established limits to ALARA, considering technical, economic, and practical constraints.

Preliminary contaminant retention goals have been established to allow initiation of the ETS design effort. These are:

1. To remove 99.9 percent of the most penetrating size of particulates and condensed phase contaminants (nominally 0.3 microns) from the effluent stream

2. To remove 99.5 percent of the gas (iodine, xenon, and krypton) and vapor phase contaminants from the effluent stream.

The stated removal efficiencies are not, at this time, intended to be interpreted as the final performance requirements for the ETS. Analysis will be performed to determine the release limits required to satisfy existing guides, regulations, and standards. These limits, when considered in conjunction with projected normal operating and accident scenarios, potential contaminant source terms, and the ALARA principle of the program, would be used to establish the final removal efficiencies of the ETS.

The stated 99.9 percent solid and 99.5 percent gas and vapor phase removal efficiencies are within the envelope of the current state of the art for filter and adsorption media. Typical air filtration efficiencies for high efficiency particulate air (HEPA) filters exceed 99.95 percent of the most penetrating particle size. Based upon data obtained during the Nuclear Furnace-1 test program at Nevada Research and Development Area (NRDA) (Los Alamos Scientific Laboratory, 1973), krypton retention efficiencies were demonstrated to be in excess of 99.5 percent. It should be noted that xenon and iodine are much more readily adsorbed than krypton. Thus the performance level defined for krypton is conservative for xenon and iodine.

The elements of a conceptual ETS which could meet these goals are presented in Figure 2.2-5 and described in the following paragraphs.

Cryogenic Hydrogen Injection. Large quantities of cryogenic hydrogen would be injected directly into the effluent stream and lower the temperature through bulk mixing. The required coolant flow rate would be established by the power generated by the test article. The pipes, valves, and associated components of the injection system would be designed to operate at an approximate pressure of 1,500 kPa (220 psi) and a temperature of about 20 K (-250° C).

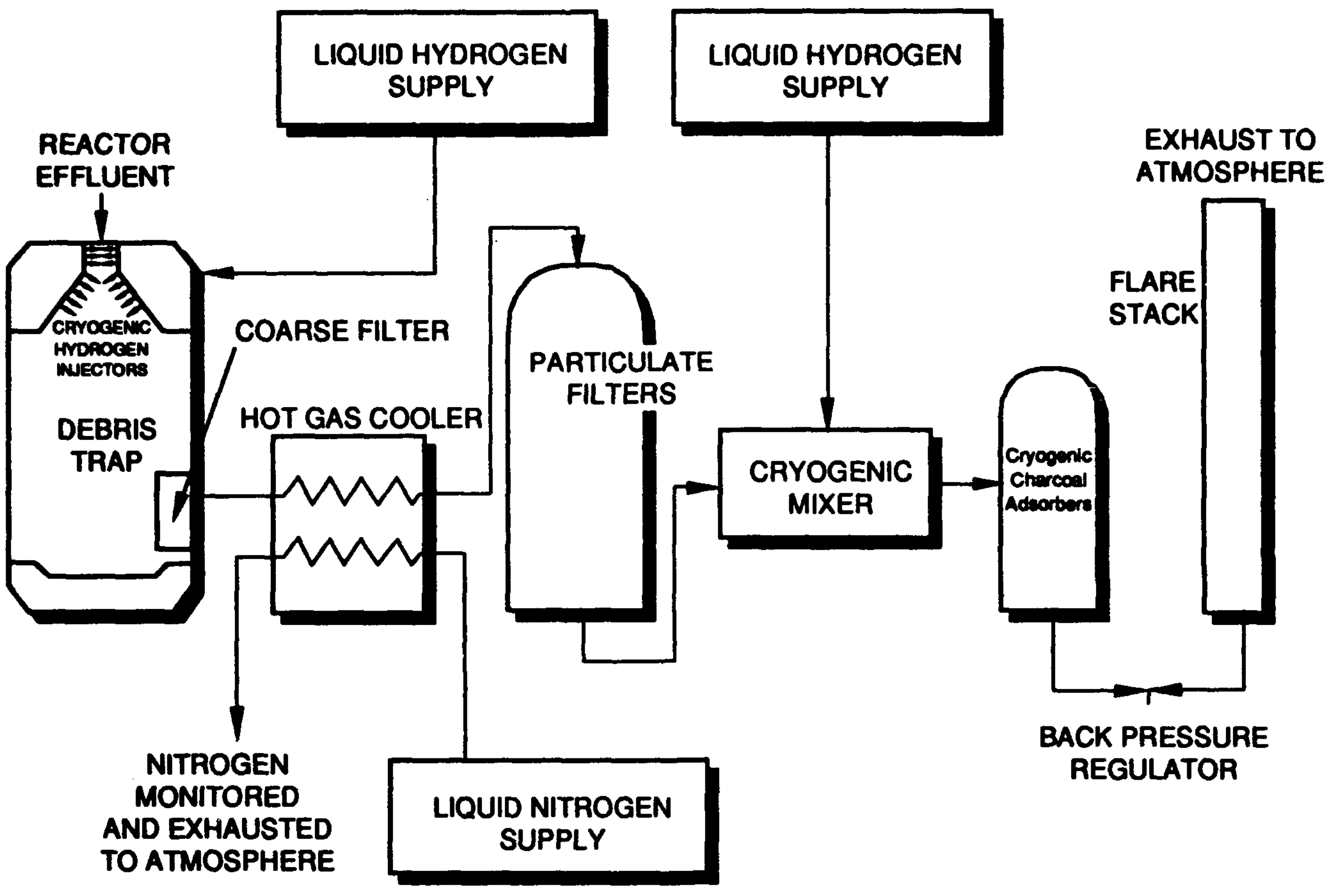
Debris Trap. A debris retention device would be incorporated into the ETS design to collect any debris that may be produced by failed fuel elements and to divert the effluent flow. This device would be designed to ensure that the material retained within it would be maintained in a subcritical configuration. It is anticipated that the majority of debris resulting from a fuel element failure would remain in the debris retention device. The debris trap would be designed to be cooled so that it may be constructed using conventional engineering materials.

Hot Gas Cooler. A gas-to-gas heat exchanger would use low temperature nitrogen to pre-cool the effluent prior to removing the noble gases. The nitrogen would be supplied from bulk liquid storage vessels. Nitrogen exiting the hot gas cooler would be monitored for contaminants and exhausted to the atmosphere. Preliminary calculations indicate that inclusion of this component could reduce the flow rate downstream of the final mixer by half. The pipes, valves, and associated components of the hot gas cooler would be designed to operate at an approximate pressure of 1,500 kPa (220 psi) and a temperature of about 75 K (-200° C).

Particulate Filter. The effluent would be passed through filter media designed to remove 99.9 percent of the most penetrating size of the remaining particulates (nominally 0.3 microns) from the stream. In addition to the efficient removal of small particles entrained in the effluent stream, the filters would also provide a certain amount of redundancy for larger particles which escape the debris retention device. Granular, sintered metal and HEPA filters, as well as other media, are being considered to perform this function.

Cryogenic Mixer. The effluent stream must be cooled to cryogenic temperatures to remove the radioactive noble gases and halogens. This final cooling would be performed by injecting cryogenic hydrogen into the effluent stream.

Cryogenic Charcoal Adsorbers. The use of cryogenic adsorption beds and cold traps are under consideration to remove 99.5 percent of the halogens and noble gases from the effluent stream. The performance of the



Effluent Treatment System: Conceptual Design

Figure 2.2-5

cryogenic adsorption beds is a function of the bed temperature, the total bed volume, and the volumetric gas flow through the bed. The bed design must consider these parameters to ensure retention of the radioactive halogens and noble gases. The applicability of cold traps may be limited due to the anticipated very low concentration of the contaminants.

Since cryogenic adsorption beds and cold traps provide only temporary retention of radioactive gases, a final collection and/or disposal method must be included in an effluent processing system. Retention of these gases for several days allows for decay of the short half-life constituents and results in a significant reduction of radioactive discharge to the environment. One option would be to isolate the cryogenic beds and/or cold traps and vent the gases to a cryopump. This concentrated waste would then be disposed of appropriately. For purposes of analysis, isolation of the adsorption beds and/or cold traps and decay of the radioactive gases followed by a controlled release to the atmosphere was evaluated as the bounding condition.

Flare Stack. Finally, the remaining treated effluent would be vented and combusted through a flare stack. Intentional burning of the remaining hydrogen effluent would prevent the accumulation and potential detonation/deflagration of the hydrogen in the vicinity of the test cell.

The flare stack would operate intermittently for short periods of time. Flaring of hydrogen would occur during and immediately following each test, for a period up to several hours. Flare ignition systems using natural gas or electricity would be used. Relative amounts of air and hydrogen would be mixed (approximately 35 to 45 parts air to 1 part hydrogen) to ensure sufficient hydrogen burning to reduce explosion risk, but still operate efficiently. Flaring is expected to involve temperatures of approximately 2,100 K (about 1,800° C); as a result, the exhaust plume will contain high heat levels. Exhaust from the flare stack would be primarily nitrogen, water vapor, oxygen, and unburned hydrogen. The heated exhaust would rise as a plume into the atmosphere. Hydrogen naturally burns with an invisible flame; the flame would rise above the top of the flare stack (specific heights of the stack and the flame are dependent on future design details).

An effluent monitoring system would measure the radioactive and particulate content of the discharge stream on a real-time basis in the various ETS stages and as released to the environment. This would alert the operator to releases of radioactivity and/or particulates approaching prescribed limits (i.e., Technical Safety Requirements and NESHAP). In addition, the monitoring system would allow for initiating methods to prevent or minimize potential releases (e.g., terminate test, isolate the filter or adsorber having degraded performance, etc.), and would also provide post-run quantitative estimates of total releases made to the environment during each run.

A number of the ETS components (potentially including but not limited to the debris trap, filter media, and adsorber beds) may become sufficiently radioactive to require special maintenance, testing, and inspection procedures to minimize occupational exposure. Features to expedite all required procedures would be incorporated into the design. The ETS design would include appropriate shielding to prevent worker exposure to ionizing radiation above acceptable levels. In addition, compatibility with special equipment such as portable shielding and remote inspection and maintenance equipment would be incorporated into the design as necessary.

Due to its function as a portion of the radionuclide confinement system, the ETS would be designed and constructed with a level of redundancy and reliability appropriate for safety. In addition, the system would be designed to satisfy the single failure criteria as adopted by the program for the confinement function and systems, and would meet the intent of all appropriate requirements specified in 10 CFR 50 as directed by the DOE Order 5480 series.

2.2.3.2 Full-Scale Facility. Several additions and modifications to the sub-scale facility would be required to create a full-scale facility (see Figure 2.2-4). Modifications include providing additional control consoles and data acquisition capabilities in the control complex and increasing the storage capacity to accommodate the irradiated fueled components associated with the larger GTAs. Additions include an expanded test complex to accommodate the GTAs, a disassembly building to enable limited on-site post-irradiation examination (PIE) activities, an EIT area to support non-nuclear component and propellant management system development activities, expansion of the existing CSS and ETS systems as necessary to provide and process the increased fluid flow rates, and a test evaluation center to enable evaluation of acquired test data.

Test Complex

The sub-scale testing capability would be modified as necessary to provide a test complex to accommodate testing of several (up to 10) GTAs. The GTA test location(s) would accommodate the larger test articles and provide the necessary fluids, power, instrumentation, and effluent treatment. The test cell design would include appropriate fire suppression systems.

At NTS, construction of additional test cells would be required (Section 2.3.1). If the existing CTF at INEL is capable of accommodating GTA testing, it would be used to support additional tests by moving the GTA to a storage location after a test and installing a new GTA in the facility. If the CTF proves to be inadequate, additional test cells would be constructed to accommodate the proposed testing (Section 2.3.2).

Disassembly Building

A disassembly building with an integral hot cell would be required to accommodate initial disassembly and post-irradiation activities for irradiated fuel elements or test reactor assemblies. The building would have a shielded area for unloading each test article from the cask used to transport the assemblies from the test cell.

EIT Area

Space would be provided within the full-scale test facility to accommodate testing of liquid hydrogen flow components for integration into the engines. Conceptual estimates indicate that an area of approximately 1,600 square feet would be required to accommodate this testing. This testing area would provide appropriate blast protection in accordance with AFR 127-100 and the DOE Explosive Safety Manual (DOE, 1990a).

Storage of gases and cryogenics to support EIT would provide for 2,900 cubic feet of GHe, 150,000 gallons of LH_2, 2,900 cubic feet of GH_2, and 2,300 gallons of liquid oxygen (LOX) anticipated to be necessary to support each test.

Expanded Process Fluids

During the full-scale facility expansion, additions will be made to the process fluid systems for supplying coolant and treating effluent. A second ETS or major expansion to the sub-scale ETS would be constructed for GTA operations. The full-scale ETS would incorporate information gathered from the sub-scale ETS operation.

Storage of gases and cryogenics at the Full-Scale Facility to support GTA would provide for 61,280,000 cubic feet of GHe, 1,920,000 gallons of LH_2, and 2,160,000 gallons of LN_2 anticipated to be necessary to support each test.

Test Evaluation Center

The Test Evaluation Center will provide office and computer/laboratory work space for the engineering team required to analyze the data generated during system tests. It will be located near the test facility, but far enough away that it can be occupied routinely when radioactive test articles are located in the test cells. It would typically be evacuated during power test operations.

2.2.4 Employment and Population

Construction and/or modification of all facilities is expected to take approximately 18 to 24 months each for both the sub-scale and full-scale test facilities, with an average work force of about 35 and a peak work force of about 100. The number of personnel on site during pre-operational activities at the sub-scale facility would be limited to about 30 security, technical, administrative, and maintenance personnel. The pre-operational staff of the full-scale facility would be approximately 50 to 60. During actual testing operations for both facilities, the number of personnel on site would be reduced to a minimum operating staff of no more than 10 individuals, all located within the control complex.

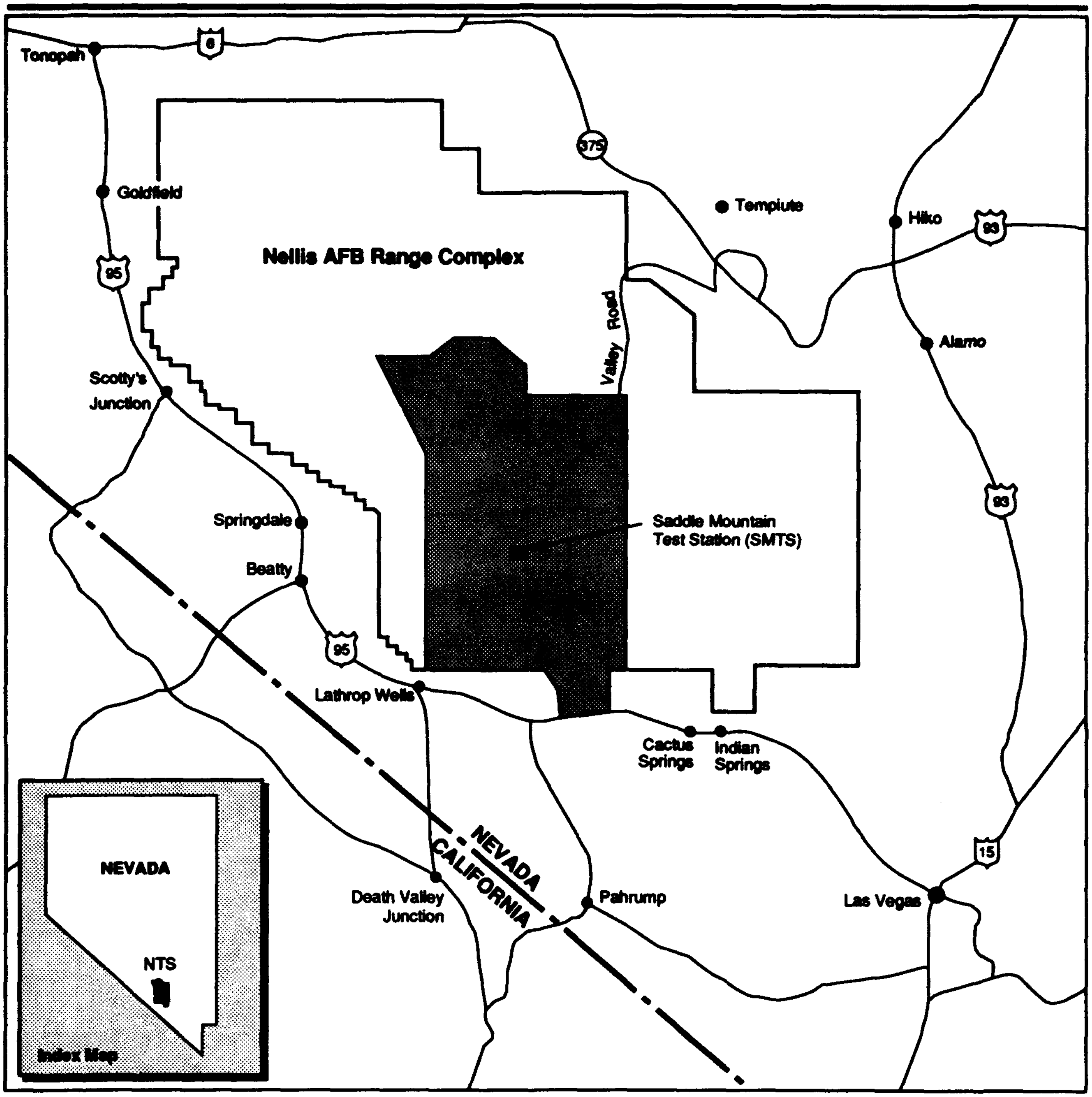
2.3 DESCRIPTION OF SITING ALTERNATIVES

Two sites at DOE installations have been identified as suitable locations for the PBR validation test facility: the SMTS site at NTS, and the CTF site at INEL. The principal exclusionary criteria considered in the site narrowing process were (1) similar nuclear activities conducted at the installation; (2) 15 kilometers (9.3 miles) minimum distance to the nearest urban area; and (3) federal ownership of the facility. Both of the DOE installations have sufficient infrastructure support. The SMTS site would require new construction for all facilities and the extension or improvement of roads and utilities. The CTF site has existing facilities and infrastructure but would require some modifications to existing facilities as well as some new construction. Both sites would require maintenance, testing, waste management, and ultimate disposition or decontamination of the test facility (The Harris Group, 1991).

2.3.1 SMTS

The SMTS (Figure 2.3-1) is located in the center of NTS, south of Mine Mountain Road and west of Saddle Mountain Road (Figure 2.3-2). Distances to the NTS boundaries from the SMTS are as follows: north 22 miles, south 19 miles, east 14 miles, and west 14 miles. Access to the test area is controlled by the NTS Safeguards and Security Branch of the Nevada Field Office Safeguards and Security Division. There is no free public access to either NTS or the Nellis AFB Range Complex.

2.3.1.1 Facility Description. Selection of the SMTS would require new construction for sub-scale and full-scale test facilities, as described in Section 2.2.3 and as shown in Figure 2.2-4. Other infrastructure required for the site includes roads, power lines, phone lines, a deep water well, and water storage tanks (Figure 2.3-3). Transportation improvements include new site roads and grading of existing access roads.



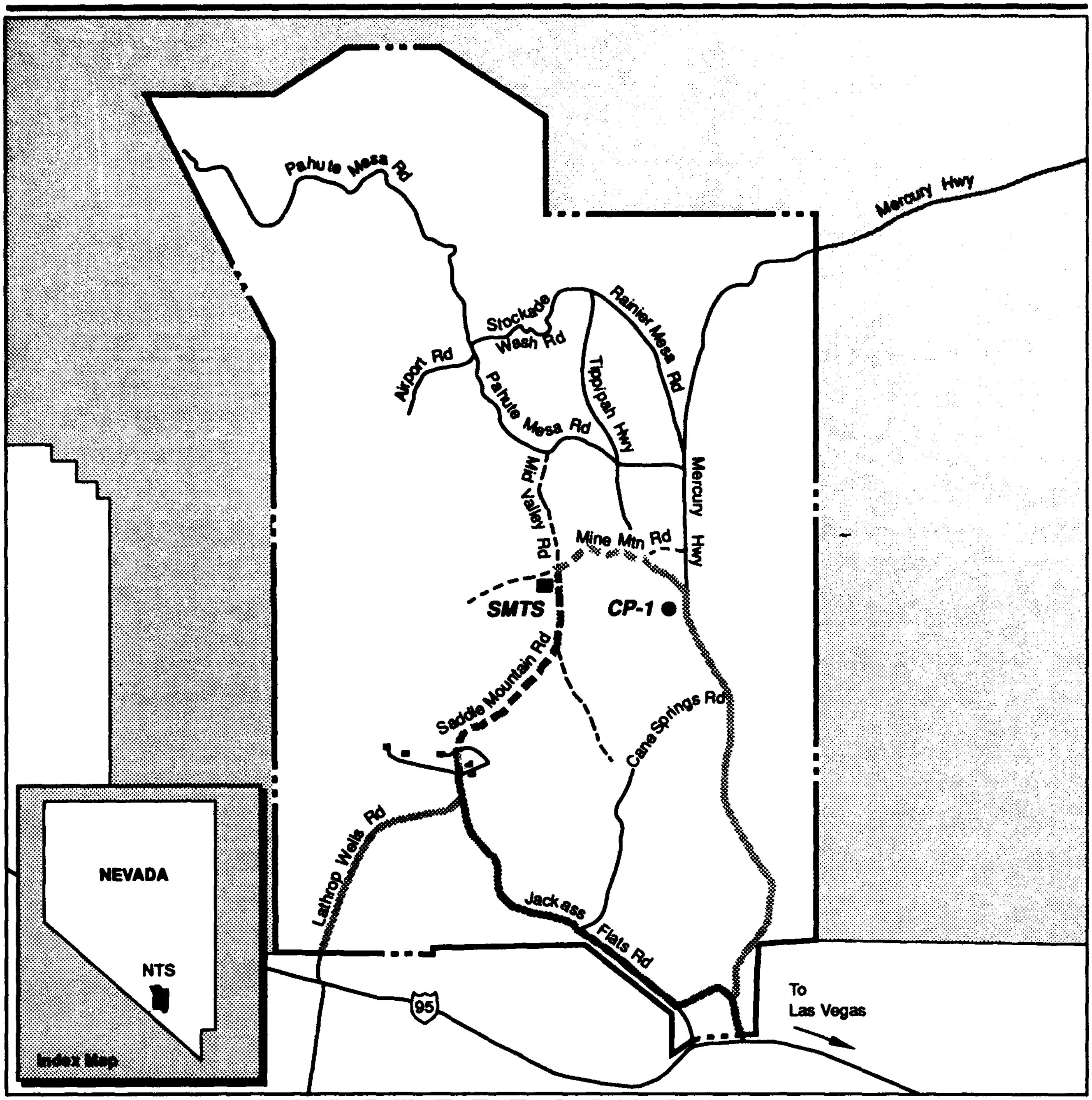
EXPLANATION

Nevada Test Site (NTS)

Nevada Test Site

0 5 10 20 Miles

Figure 2.3-1



EXPLANATION

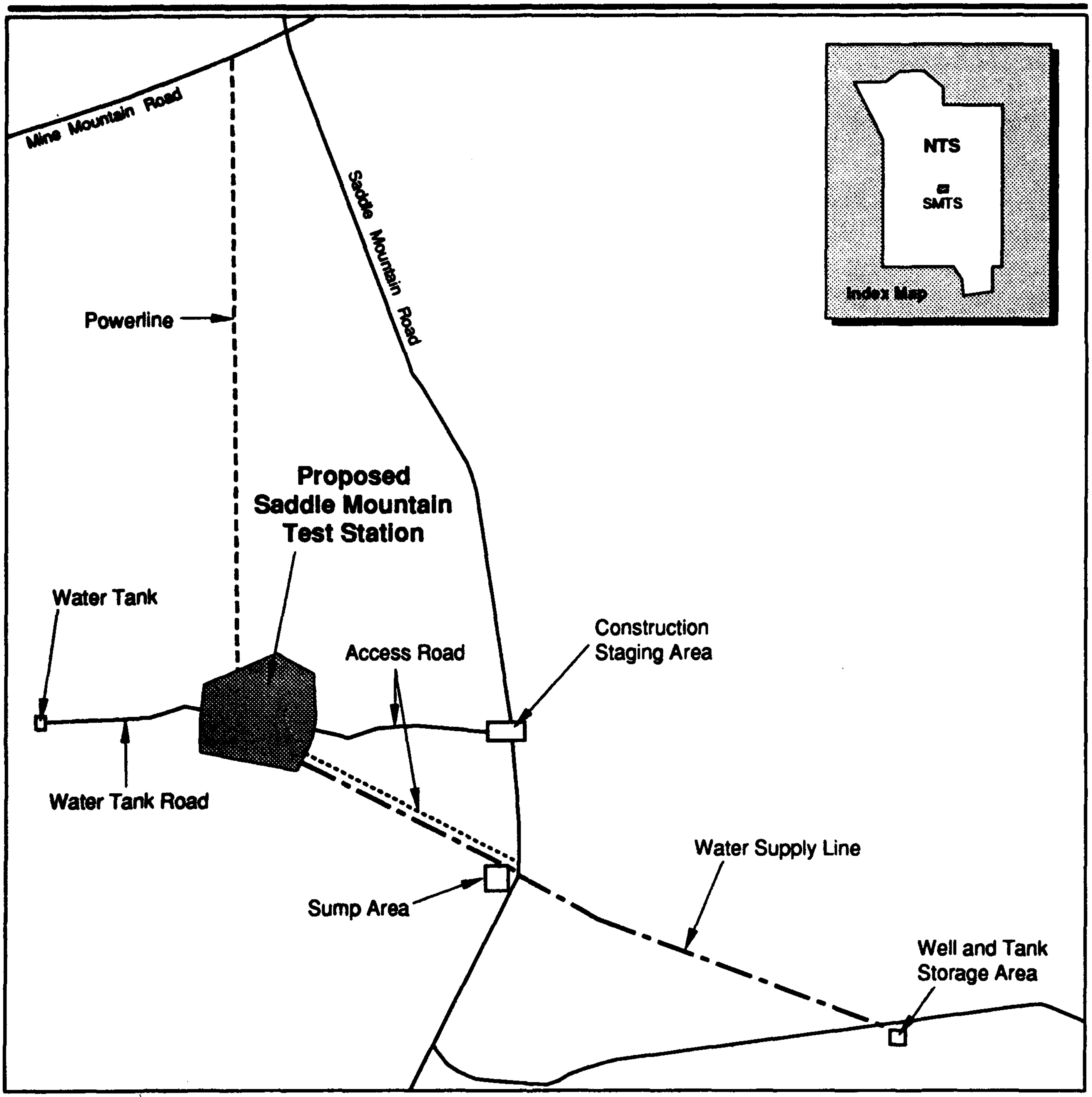
— — — —	Unpaved Road	(primary)	Primary Access Road (dashed where unpaved)
———	Paved Road		
— – – —	Nevada Test Site	(alternate)	Alternate Access Road (dashed where unpaved)
(shaded)	Nellis Air Force Range	● *CP-1*	Control Point 1

0 2 4 8 Miles

Nevada Test Site

Saddle Mountain Test Station Location

Figure 2.3-2



EXPLANATION

- Existing Road
- Proposed Road
- Proposed Power Line
- Proposed Water Line

0 500 1000 2000 Feet

Nevada Test Site

Proposed SMTS Site Layout

Figure 2.3-3

2.3.1.2 Infrastructure Requirements

Roads

Road access to the SMTS would be via either the northern route (Mercury Highway to Mine Mountain Road) or the southern route (Saddle Mountain Road) (Figure 2.3-2). Both Mine Mountain Road and Saddle Mountain Road are unimproved gravel roads. These roads could be used in their existing condition with grading, watering, and compaction as required. Maintenance of the roadway infrastructure on NTS, including these access roads, is the responsibility of DOE.

Power and Telephone Lines

A 34.5 kilovolt (kV) overhead power distribution line approximately 2.4 miles long would be required to connect the facility to the existing 138 kV power transmission line along Mine Mountain Road. The installation of a stepdown transformer would also be required. Additional short-term electrical capacity which may be needed for the SMTS could be provided by large transportable generators. A telephone line approximately 2 miles long would be required to tap into the existing telephone lines.

Sanitary Sewage System

A sanitary sewage system would be required for the peak 50 to 60 person on-site staff during test preparation. The most appropriate system for the site would be an on-site septic system. It is anticipated that less than 2,400 gallons per day of sanitary waste would be produced.

Water Supply

Water would be provided from an existing 3,680-foot-deep, large-diameter exploratory drill hole located near the center of Mid Valley, about 2.1 miles southeast of the SMTS. The well is not used for water supply purposes for any other activities at NTS. Pumping depth would be at about 2,000 feet below the surface. For construction and the sub-scale tests, a sunlight-treated polyvinyl chloride water supply line to the SMTS would be laid on the ground surface and a portable generator would be used to power the pump for replenishing the water tank. For the full-scale systems tests, consideration would be given to constructing a 1.5-mile-long buried water line. Wellhead development would consist mainly of laying a concrete pad and installing necessary pipes and valves. Access to the wellhead is by an existing unimproved road. Water would be stored in two 250,000-gallon storage tanks which would be placed in an elevated area of the site.

Excavation

Construction of the test facility would require earth removal and fill for the test site and water tank installation and grading of the roads. The cut and fill required are approximately 26,000 cubic yards and 37,000 cubic yards, respectively. The total area disturbed at the SMTS is anticipated to be less than 100 acres.

2.3.2 CTF

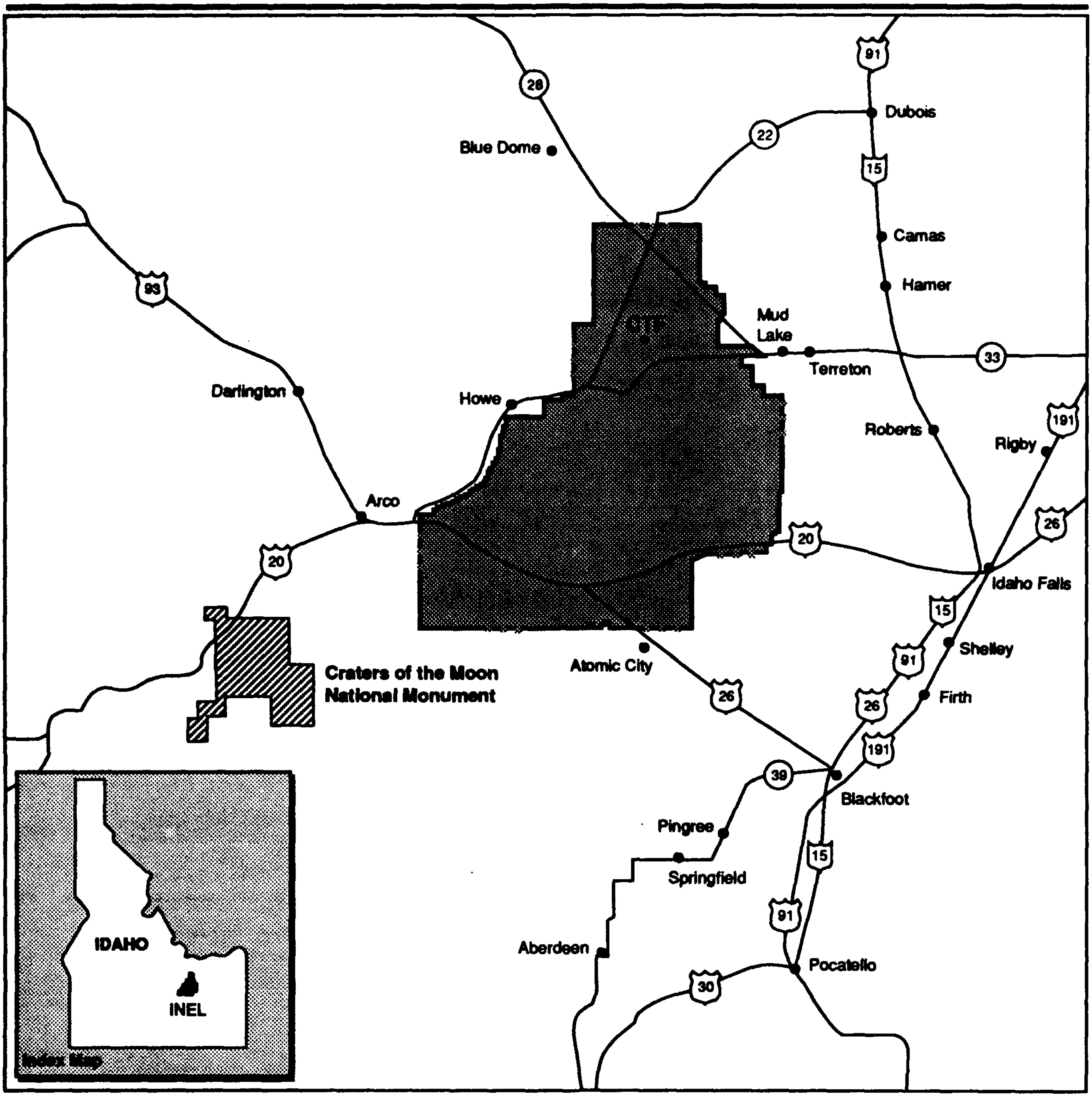
The CTF (Figure 2.3-4) is located in the northern portion of INEL, northwest of the intersection of Lincoln Boulevard and State Highway 33 (Figure 2.3-5).

Some existing facilities that could support PBR validation testing are already located at the CTF site. Approximate distances to the INEL boundaries are as follows: north 11 miles, south 28 miles, east 11 miles, and west 8 miles.

2.3.2.1 Facility Description. Existing facilities at the CTF site consist of a receiving/assembly/hot cell facility, an American Society of Mechanical Engineers-certified pressure vessel (containment structure rated to 40 psi), a control bunker, post-irradiation examination facilities, and administrative space. An approximately 1.6-mile railroad track connects the containment structure to the receiving/assembly/hot cell facility (Figure 2.3-6). A security fence with guard stations is also in place.

A number of modifications to the existing facilities would be required. It is likely that the control building would have to be reconfigured to accommodate the tests. The receiving/assembly/hot cell facility may require modest modification to accommodate the hot test articles. The hydrogen and helium storage area would be located to the northeast of the CTF. Construction and operation of the storage area and flare stack may require the relocation of a National Oceanic and Atmospheric Administration (NOAA) meteorological tower; this tower would be moved within the site area. For the sub-scale tests, portions of the ETS would probably be located within the CTF, with the hydrogen and nitrogen supplies located to the east of the CTF. Engineering studies have been initiated to determine if the CTF or new test cells would be required for the full-scale test. New test cells, if required, would be located adjacent to the CTF.

Use of the existing CTF containment structure as the sub-scale test cell would require construction of process fluids storage and piping, the ETS, and the flare stack. The test article would be secured to one of the special rail cars, moved to the CTF containment structure, and connected to coolant fluids and the ETS. Following the test and after a cool-down period, the test article could be moved directly to the hot-cell facility for disassembly



EXPLANATION

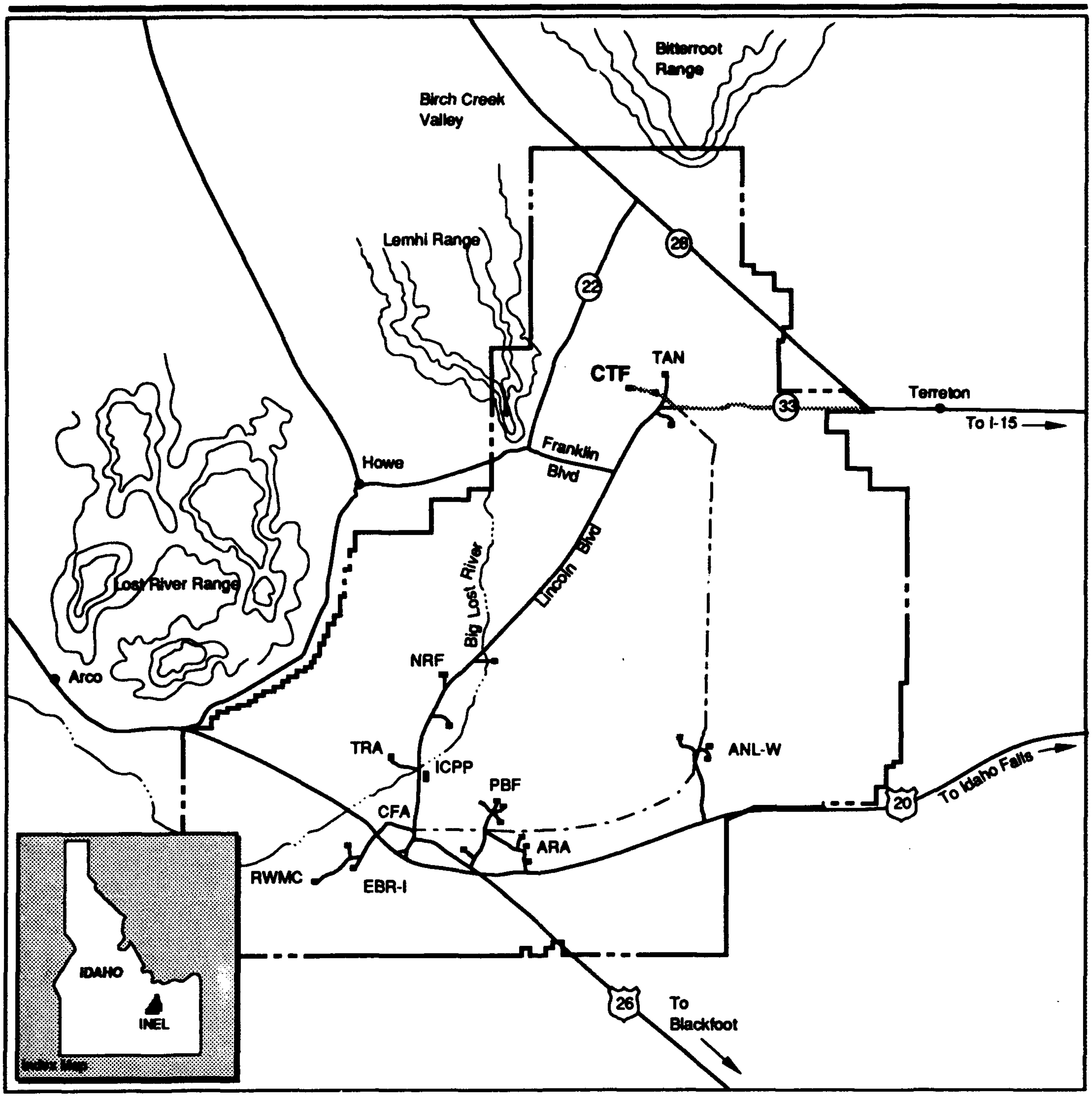
Idaho National Engineering Laboratory

CTF Contained Test Facility

0 5 10 20 Miles

Idaho National Engineering Laboratory

Figure 2.3-4



EXPLANATION

— - — Transmission Line

——— Paved Roads

.... Access Road

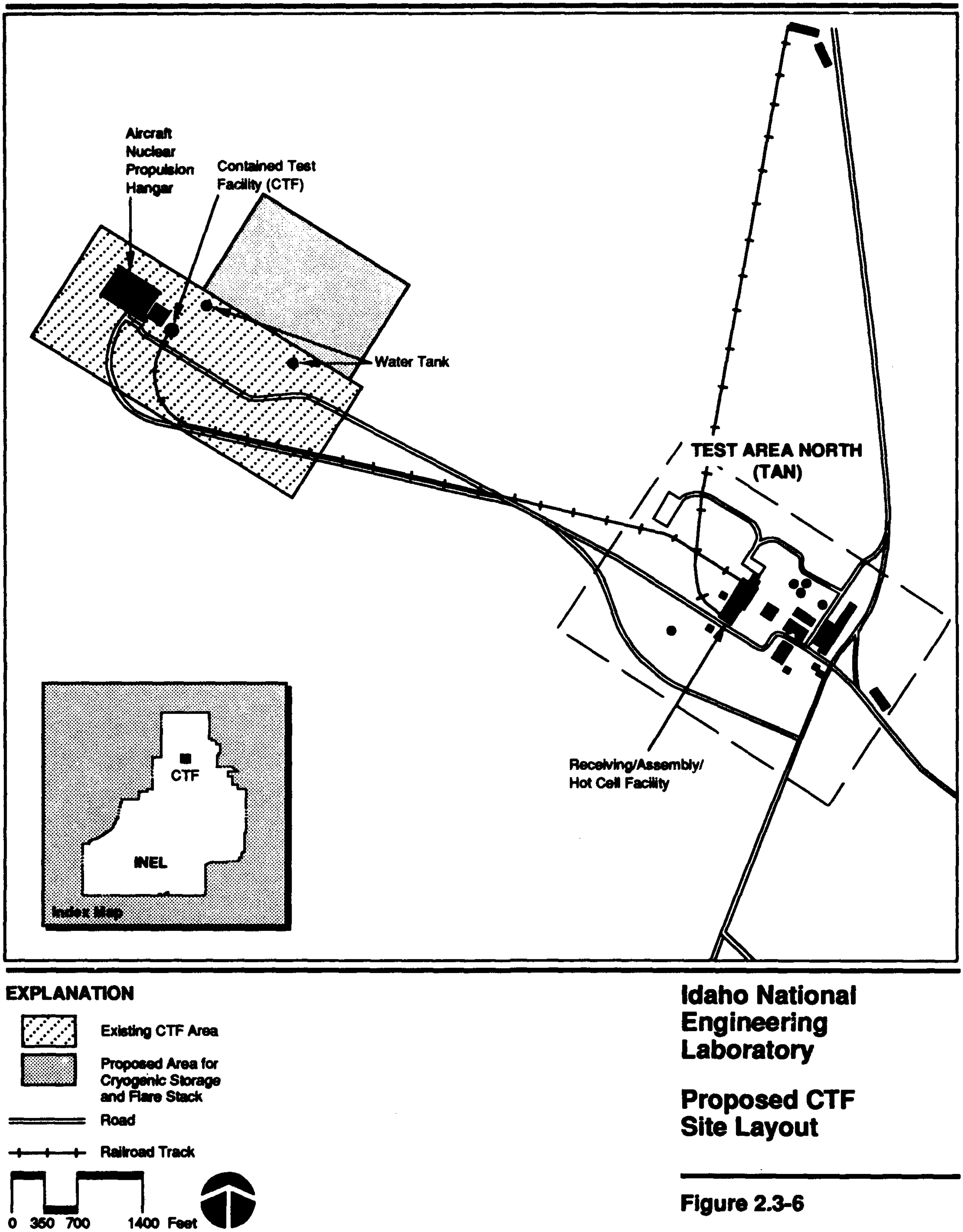
ANL-W - Argonne National Laboratory West
ARA - Auxilliary Reactor Area
CFA - Central Facility Area
CTF - Contained Test Facility
EBR-I - Experimental Breeder Reactor-I
ICPP - Idaho Chemical Processing Plant
NRF - Naval Reactors Facility
PBF - Power Burst Facility
RWMC - Radioactive Waste Management Complex
TAN - Test Area North
TRA - Test Reactor Area

0 2 4 8 Miles

Idaho National Engineering Laboratory

Contained Test Facility Location

Figure 2.3-5



Idaho National Engineering Laboratory

Proposed CTF Site Layout

Figure 2.3-6

and PIE. Engineering studies are underway to determine renovation requirements for the CTF vessel to provide for coolant flow, debris collection, exhaust of propellant, purging, inerting, and venting.

2.3.2.2 Infrastructure Requirements. Infrastructure required for the activities is already in place at the site. This includes paved roads, power lines, telephone lines, a sanitary system, and a water supply. Intermittent PBR validation testing may require closure of State Highways 33, 28 or 22 for short durations of less than 1 hour. Traffic would be rerouted to the two open highways.

Excavation

Modification and construction of the test facility would affect less than 50 acres of previously disturbed land adjacent to the containment structure. Excavation requirements are approximately 11,000 cubic yards.

2.3.3 Transportation of Hazardous and Radioactive Materials

Various quantities of GHe, LH_2, LN_2, and LOX would be required for PIPET, EIT, and GTA tests (Sections 2.2.3.1 and 2.2.3.2). Table 2.3-1 lists the limited source locations of large quantities of GHe and LH_2, the number of trips to support all tests, and the transportation requirements to supply these materials to both the SMTS and CTF. LN_2 and LOX may be procured from local suppliers and could be expected to require approximately 3,500 and 15 total trips for LN_2 and LOX, respectively.

Table 2.3-1. LH_2/GHe Transportation Options, Program Lifetime

Materials	Potential Source	Destination	Miles	Total No. Trips	Total Miles
GHe	Kelly AFB (San Antonio, TX)	SMTS	1,375	5,600	7,700,000
GHe	Kelly AFB (San Antonio, TX)	CTF	1,600	5,600	8,960,000
LH_2	Air Products (Sacramento, CA)	SMTS	500	3,400	1,700,000
LH_2	Air Products (Sacramento, CA)	CTF	800	3,400	2,720,000
LH_2	Air Products (Tonawanda, NY)	SMTS	2,375	3,400	8,075,000
LH_2	Air Products (Tonawanda, NY)	CTF	2,100	3,400	7,140,000
LH_2	Linde Corp. (Ontario, CA)	SMTS	300	3,400	1,020,000
LH_2	Linde Corp. (Ontario, CA)	CTF	925	3,400	3,145,000

The distances in Table 2.3-1 and resulting analyses are based primarily on the use of trucks to transport the gases and cryogenic liquids. Modes of transport (e.g., trucks or rail) would be selected by the supplier based on cost, efficiency, and scheduling. If rail were used, the material would need to be transferred to truck at some point, because neither site alternative has a rail spur accessing the site. The program would not build new rail spurs for this activity.

The number of trips and transportation requirements for U-235 is discussed in Appendix E. The impacts of potential accidents involving the transport of U-235 are discussed in Section 4.12.2.4.

2.4 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the Air Force would not proceed with the SNTP program. Component assembly, fabrication, and validation testing would not be carried forward, and the PBR-propelled rocket technology would not be developed or validated.

2.5 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

Early in the SNTP program planning, several other alternatives were considered but were eliminated as unacceptable. These alternatives are briefly discussed below.

2.5.1 Alternative Propellant

One alternative considered but not carried forward would be to use helium rather than hydrogen as the propellant. Helium is not a suitable coolant for the fuel elements at high power. Since the specific heat of helium is lower than that of hydrogen, a higher helium flow rate is required to remove a given quantity of heat. The higher helium flow rate, in conjunction with its higher molecular weight, results in a pressure drop across the fuel element, for any given operating power, that is higher than that for hydrogen. At a sufficiently high power level, the helium pressure drop may threaten the integrity of the fuel element. In addition, the specific impulse (I_{sp}) of a rocket engine is inversely proportional to the square root of the molecular weight of the propellant. Thus, the use of helium as a propellant would result in an I_{sp} that is about 70 percent of that for hydrogen. Even if lower I_{sp} was acceptable, liquid helium would require storage and handling at a temperature of approximately 4 K (-269° C), a substantial increase in complexity over hydrogen storage requirements at 20 K (-253° C).

2.5.2 Materials and Components Testing Alternatives

2.5.2.1 Simulation of Testing and Operating Conditions. Another alternative considered but not carried forward would be the simulation of

testing and operating conditions in place of physical testing. The performance of materials, components, and assemblies could be simulated by computer codes. Significant simulation is presently included in the program and extending this effort would be possible. However, simulation of testing and operating conditions does not allow validation of component performance and, therefore, would not meet program goals.

2.5.2.2 Integrated Bench Scale Tests. Another alternative considered but not carried forward would be to perform only bench or laboratory scale tests that incorporate PBR technology and not conduct testing at the sub-scale facility. The use of this alternative to develop the PBR technology would not fully demonstrate the viability of the concept. Many of the key technical issues relate to fuel or fuel element performance under typical reactor operating conditions. For the PBR, these conditions can only be simulated on a complete fuel element in the sub-scale facility. Bench or laboratory scale tests are anticipated to be a key part of development work leading up to the sub-scale facility but not to replace it.

2.5.2.3 Continued Research and Development of Components and Assemblies. Another alternative considered but not carried forward is to continue research and development of the rocket components and assemblies until more data are available on the new technologies being developed. This would extend the schedule without moving toward meeting the objectives of the program.

2.5.3 Alternative Locations

2.5.3.1 Initial Site Screening. The initial screening began with a review of continental United States locations that were federally owned sites and had access control systems in place. The sites were screened further for similarity of operations. Several Department of Defense sites were considered (e.g., Tonopah Test Range, Nevada, and Edwards Air Force Base, California) but none hosted similar nuclear research operations. The remaining sites were all DOE sites.

Early in the site narrowing process, several candidate locations within the Nevada Test Site were evaluated for use as a PBR validation test station. With the exception of some existing facilities at the NRDA (formerly referred to as the Nuclear Rocket Development Station), the remaining candidates were dismissed due to unfavorable topography, inaccessibility, or refurbishment efforts which were obviously significant and considered uneconomical. Major components of the NRDA test facilities had been removed and reapplication for PBR testing was not considered reasonable. Only the engine maintenance and disassembly (E-MAD) facility was considered to be a reasonable candidate to support validation test activities. However, the costs to refurbish the E-MAD facility so that a relatively small part of it would be available to support PBR validation were estimated to be

substantially higher than the cost of building a small facility capable of stabilizing these specimens prior to transport and shipping them to an existing hot cell facility for the PIE. The program concluded that this latter approach was a more cost-effective method of conducting PIE and would reduce the overall construction impacts by eliminating an extensive renovation effort. Finally, the entire NRDA is habitat for the desert tortoise which is a federally protected threatened species, which the program sought to avoid impacting.

The second step was the exclusion of sites located less than 15 kilometers (9.3 miles) from urban areas. This resulted in the elimination of all but four sites.

The remaining sites at Hanford (Richland, Washington), INEL, NTS, and Savannah River Site (SRS) (Aiken, South Carolina), were then evaluated for mission compatibility. The Hanford Site was excluded for incompatibility with existing operations; no suitable 100-acre location was available that was compatible with existing or planned operations. The entire installation is currently undergoing environmental restoration in accordance with a memorandum of agreement with the state of Washington. SRS also was eliminated due to incompatibility with existing operations. SRS produces plutonium, tritium, and other nuclear materials for United States defense programs. SRS is currently the primary source for tritium production in the United States. The need to maintain separation between the SNTP test facilities and tritium production facilities would not allow appropriate siting of the project at SRS. SRS is surrounded by wetlands in the south and east and is bisected by public roads to the north. Alternate locations would have required siting on special status lands and would have increased public safety concerns. Two sites at INEL (Quest and CTF) and one site at NTS (SMTS) were retained for further study.

2.5.3.2 Quest Site. Although the Quest site was considered a viable alternative when this environmental analysis process began, it has since been eliminated from consideration, and is not analyzed further in this EIS. The rationale for this decision, which was made by the Air Force in May 1992, is outlined in this section (more detailed background information is contained in Appendix G).

The Quest site is in an undeveloped, remote area located in the east-central portion of INEL. Because earlier surveys along the road leading to the Quest site led to the discovery of many prehistoric archaeological sites, the Air Force commissioned a survey of the Quest site area that could be affected by construction of the PBR validation test facility. This survey, which was performed in April 1992, revealed the presence of an unusually high number of diverse cultural materials. Included among the finds was an extensive scattering of lithic and ceramic materials with features that included hearths and associated fire-cracked rock; pottery sherds; burned bone/tooth enamel

fragments associated with lithic materials; an extensive packrat midden; and chinked stone walls of undetermined purpose that are unique on INEL. These discoveries are consistent with site types that include hunting locations, field camps where game processing occurred, and tool modification areas. Additionally, the packrat midden is similar to those that have, in the past, revealed important paleontological remains.

Because of the amount, richness, and diversity of the cultural materials found, the Quest site (virtually all of which has, to date, escaped disturbance) has the very definite potential to contribute significantly to an understanding of North American and Idaho prehistory. Many of the sites are consequently likely to be eligible for inclusion in the National Register of Historic Places.

The potential importance of the Quest site from a cultural resources standpoint has convinced the Air Force that it would be imprudent to continue to carry the Quest site as an alternative location for the PBR test facility. Although the Air Force could, consistent with current cultural resources laws and regulations, perform data recovery at the Quest site and thereafter proceed to construct the proposed test facility, this would result in the loss of these prehistoric sites forever. Because other suitable locations for the PBR validation test facility exist, the Air Force has concluded that potential destruction of apparently significant prehistoric sites is unwarranted. Consequently, in late May 1992, the Air Force eliminated the Quest site from further consideration and analysis in this EIS.

2.6 PREFERRED ALTERNATIVE

The Air Force's preferred alternative is to facilitate development of nuclear thermal propulsion technology by constructing and operating a PBR validation test facility. Based on environmental considerations alone, both NTS and INEL appear to be acceptable candidate locations for the test facility. Nonetheless, to meet requirements of the Council on Environmental Quality regulations, and predicated principally on the fact that it has been used for similar types of test activities in the past, the Air Force presently prefers NTS as a location for the test facility. It must be emphasized, however, that no decision concerning whether and where to construct and operate a PBR validation test facility will be made until:

1. The Air Force and DOE have had an opportunity to consider fully the environmental impacts identified in this EIS and weigh them against other relevant factors, including economic and technical considerations and the two agency's respective statutory missions; and

2. The DOE Energy System Acquisition Advisory Board (ESAAB) has completed its site selection process and made a final

recommendation to the Secretary of Energy concerning which candidate site is preferred if the Air Force decides to proceed with the PBR validation test program.

The Air Force's final decision, as well as DOE's site selection, will be documented in one or more formal Records of Decision that will be made available to the public. Until these Records of Decision are issued, the Air Force shall take no action concerning the SNTP program that would have an adverse environmental impact or limit the Air Force's ability to choose among the reasonable alternatives, including the No-Action Alternative.

2.7 OTHER FUTURE ACTIONS IN THE REGION

Several ongoing or potential future actions were reviewed in context of cumulative environmental impacts if performed in combination with SNTP PBR validation testing.

Yucca Mountain, Nevada, which is being considered as a location for a high-level radioactive waste repository on NTS, is undergoing a site characterization program which is expected to continue for some time (DOE, 1988b, 1988d). The Yucca Mountain site characterization program was considered in context of the NTS baseline conditions, and impacts with SNTP were analyzed as such.

The DOE is also currently studying three general categories of potential actions:

- Development and implementation of environmental restoration activities at all DOE facilities
- Development and implementation of revised waste management practices at all DOE facilities
- Reconfiguration of the DOE nuclear weapons complex, to consolidate existing activities.

Each of these actions, and the relative potential for cumulative impacts with SNTP at NTS or INEL, are discussed below, and analyzed where applicable in Section 4.5 (Hazardous Materials and Hazardous Waste Management).

Environmental Restoration

The environmental restoration program includes investigation of potentially contaminated sites, implementation of remediation measures, and development of long-term management procedures. Environmental restoration studies can be used to develop detailed strategies on the most effective methods for cleaning up contaminated sites or managing the sites

to ensure that future impacts from the sites do not exceed regulatory requirements and DOE environmental goals. A series of general alternatives was developed in DOE, 1992f.

Proposals for restoration activities include the No-Action Alternative (in which current management practices would continue), a series of Institutional Control Alternatives (i.e., leaving the contamination in place, and implementing measures to reduce or control risk of health and safety impacts), a series of Removal and Treatment Alternatives, and alternatives implementing various combinations of methods. Specific alternatives for individual DOE facilities have not yet been developed.

The schedule of implementation of one or more of the alternatives is still unknown; several additional studies are required prior to implementation of a proposed program. The primary potential for cumulative effects is in the area of hazardous waste management. There are insufficient details available to quantitatively analyze these potential effects; however, qualitative discussions are provided in Sections 4.5.1.4 and 4.5.2.4. Remaining aspects of the program are currently too speculative to be able to assess cumulative impacts for other resource areas (e.g., biological resources, air quality, etc.).

Waste Management

The DOE is currently studying numerous alternative methods of revising waste management procedures, reorganizing the waste management system, and consolidating activities for all DOE facilities. A description of waste management alternatives has recently been developed (DOE, 1992e). Waste management alternatives will consider hazardous wastes, high-level radioactive wastes, low-level radioactive wastes (LLW), low-level mixed wastes, transuranic (TRU) wastes, greater-than-Class C wastes, and DOE spent nuclear fuel (refer to the DOE Orders for descriptions of waste types).

Waste management alternatives for all waste types except spent nuclear fuel include a series of Minimum Consolidation Alternatives, in which portions of waste treatment, storage, and disposal activities would be consolidated to fewer DOE facilities; a series of Maximum Consolidation Alternatives, in which wastes from most facilities would be accumulated, treated, stored, and disposed of in a very small number of DOE facilities; and the No-Action Alternative, in which current practices and locations would continue.

For spent nuclear fuel, the alternatives include the Decentralization Alternative (limited consolidation of sites); Regionalization Alternative (consolidation by fuel types); Centralization Alternative (maximum consolidation); and the No-Action Alternative.

Based on these alternatives, waste facilities at NTS and/or INEL could be used to consolidate treatment, storage, and/or disposal of TRU waste, LLW, low-level mixed waste, or hazardous waste from other DOE installations.

The schedule of implementation of one or more of the alternatives is still unknown; several additional studies are required prior to implementation of a proposed program. The study is too preliminary, and program specifics are too speculative to evaluate potential cumulative impacts in combination with the SNTP program for most environmental resource areas; however, sufficient data are available to identify some relative levels of potential cumulative impacts related to hazardous waste management (Sections 4.5.1.4 and 4.5.2.4).

Reconfiguration of Nuclear Weapons Complex

The DOE is also studying alternatives to consolidate the geographically separated nuclear weapons development and production facilities to one or a few DOE sites (DOE, 1991b, 1992a). This study includes a series of proposals to consolidate the Nonnuclear Element to one of several facilities, some presently undefined alternatives to consolidate the Research, Development, and Testing Element, and a range of proposals to relocate some or all of the Nuclear Element facilities at one (or very few) DOE facilities. INEL is being considered as one site alternative for consolidation of the Nuclear Element.

The reconfiguration project is too preliminary and speculative to assess cumulative impacts for most environmental resource areas. If INEL is selected for both SNTP and Nuclear Weapons Complex reconfiguration, potential cumulative impacts could include hazardous waste management. Amounts of hazardous wastes generated by this program would be a small percentage of those involved in the waste management action (DOE, 1992a). Specific amounts of waste expected have not yet been determined. Therefore, potential cumulative effects of this program can only be qualitatively addressed at this time.

2.8 COMPARISON OF ENVIRONMENTAL IMPACTS

Environmental impacts are summarized in Table 2.8-1.

Table 2.8-1. Summary of Impacts from Alternatives

	Proposed Action at SMTS	Proposed Action at CTF	No-Action
Local Community			
Land Use	No impact	No impact	No impact
Population	263; less than 0.04% increase	263; less than 0.2% increase	No impact
Employment	100 personnel; 2% increase	100 personnel; less than 1% increase	No impact
Transportation	Maximum of 5.9% increase in AADT	Maximum of 6.1% increase in AADT	No impact
Utilities			
Water	Less than 0.5% increase in withdrawal	Less than 0.1% of allocation	No impact
Electrical	New distribution line to the site required; 0.75 MW peak power requirement	Less than 1% of existing capacity required	No impact
Wastewater	2,400 gal/day: septic system/leachfield to be constructed	2,400 gal/day: less than 1% of existing capacity to be used	No impact
Solid Waste	Less than 1% increase	Existing landfill site contains sufficient capacity for solid wastes	No impact
Hazardous Materials/Waste			
Materials	Shipment of less than 220 pounds of U-235 per year (as part of component assemblies)	Shipment of less than 220 pounds of U-235 per year (as part of component assemblies)	No impact
Waste	Less than 2% increase per year	Less than 1% increase per year	No impact
CERCLA	No impact	No impact	No impact
Radioactive Materials	Approximately 9% of existing capacity for disposal of low-level waste (LLW) required.	Approximately 46% of existing capacity for disposal of LLW required. LLW with TRU greater than 10 nanocuries per gram (PBR fuel elements that would be much less than 1 percent of total LLW) would be stored at existing INEL storage facility; ultimate disposal is pending DOE revisions to waste management practices.	No impact
Natural Environment			
Air Quality	Slight increases in PM_{10} emissions and emissions from construction and worker vehicles. No impact on air basin attainment.	Slight increases in PM_{10} emissions and emissions from construction and worker vehicles. No impact on air basin attainment.	No impact
Biological Resources	Up to 1,000 Joshua trees impacted by construction; temporary impacts to wildlife during operations due to noise; no impact to sensitive habitats; loss of 100 acres of vegetation; possible loss of birds in flare stack. Road maintenance could impact desert tortoise; implementation of existing mitigations would be required.	Temporary impacts to wildlife during operations due to noise; no impact to sensitive habitats or threatened and endangered species; possible loss of birds in flare stack (bald eagles are known to occur in nearby mountain areas but mitigation measures could reduce potential impacts); loss of less than 50 acres of previously disturbed vegetation.	No impact
Cultural Resources	No adverse impacts	No adverse impacts to potentially significant historic resources (CTF) if mitigations identified by consultation process are implemented.	No impact
Geology & Soils	26,000 cubic yards of cut, 37,000 cubic yards of fill; new construction required to meet standards for Seismic Zone 4	11,000 cubic yards of excavation. New construction required to meet standards for Seismic Zone 2B; new facilities are sited in likely floodplain; however mitigation measures could reduce potential impacts.	No impact
Noise	Temporary impacts to wildlife during operations; 390 acres exposed to 60 dBA or greater	Temporary impacts to wildlife during operations; 390 acres exposed to 60 dBA or greater	No impact
Water Resources	No impact on water table or water quality	No impact on water table or water quality	No impact
Health and Safety*			
Maximum Yearly Release	0.16% of environmental dose	0.34% of environmental dose	No impact
Total Lifetime Dose	0.07% of environmental dose	0.14% of environmental dose	No impact
Maximum Case Accident	6.1% of environmental dose**	7.5% of environmental dose**	No impact

* Exposures are shown for a hypothetical maximally exposed individual; average exposures would be much less.
** Assumes no evacuations and no mitigation measures.

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3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes environmental conditions at the two alternative locations for Space Nuclear Thermal Propulsion (SNTP) program activities: the Saddle Mountain Test Station (SMTS) and the Contained Test Facility (CTF), including the region of influence at each location. Information is provided to serve as a baseline from which to identify and evaluate environmental changes resulting from the Proposed Action or alternatives. Although this Environmental Impact Statement (EIS) focuses on the biophysical environment, some non-biophysical elements such as land use, public utility systems, and transportation networks in the region are addressed. This chapter also describes the storage, use, and management of hazardous materials. Finally, the pertinent natural resources of air quality, biological resources, cultural resources, geology and soils, noise, water resources, and health and safety are described.

Regions of influence will be defined for each affected resource and will determine the geographical area to be addressed as the affected environment. The region of influence assigns boundaries that reflect the true geographical limit of the specific resource, defines areas that encompass all potential impacts, provides context to allow regional analyses, where appropriate, and uses comparable study units when utilizing existing data bases. Although the direct project area constitutes the region of influence limit for most resources, potential impacts associated with certain issues (e.g. air quality, transportation, and water resources) transcend these limits.

Baseline conditions assumed for the purpose of analysis are the conditions as they currently exist. Impacts associated with potential program activities may then be addressed by comparing projected conditions to existing conditions.

3.1.1 Local Community

3.1.1.1 SMTS. The SMTS is located near the geographic center of the Nevada Test Site (NTS), about 75 miles northwest of Las Vegas, and lies in Mid Valley, a basin located east of Shoshone Mountain (see Figure 2.3-2). The NTS is in southern Nye County, Nevada (see Figure 2.3-1). The NTS contains 861,000 acres of federally owned land with restricted access, and is bordered on three sides by the Nellis Air Force Range (2,636,800 acres), another federally operated restricted area (Department of Energy [DOE], 1990d).

The region of influence for population is defined as Nye County and Clark County, Nevada, to include the main population center for Clark County, which is the city of Las Vegas. Nye County contains mostly rural areas, with small communities separated by great distances. The total population according to 1990 census data for the two-county region of influence is 759,240.

The region of influence for employment is defined as the NTS. Total employment at the NTS is approximately 5,000, which includes government and contractor personnel.

The NTS has been the primary location for the testing of nuclear devices in the United States since 1951. Historic testing at NTS includes atmospheric testing in the 1950s and early 1960s, earth-cratering experiments, and open-air nuclear reactor engine testing. Since 1963, all nuclear weapons tests have been carried out underground because of the limited test ban treaty.

The NTS, in addition to its primary mission as the site for the nation's nuclear weapons test program, was also the principal location for ground-based testing of nuclear rocket engines in the 1960s and early 1970s. Other tests of reactors, such as the Super Kukla, have been conducted at the NTS. From 1959 to 1973, the Nevada Research and Development Area (NRDA) conducted full-scale tests on over twenty reactors, including Kiwi, Peewee, Phoebus, Tory, NRX, and XE, which were being tested as possible propulsion systems for manned exploration of deep space. The NRDA was incorporated into the NTS in 1974.

In addition to the above tests, the Bare Reactor Experiment - Nevada was also conducted on a 1,527-foot-tall tower located in Area 4. The tower is now located in Area 25 of the NTS. The tower was originally constructed for joint United States/Japanese Atomic Bomb Casualty Commission studies to determine the approximate exposure experienced by the survivors of the Hiroshima and Nagasaki bombings. The tower contained an unshielded reactor on an outside elevator to determine dose by distance and shielding measurements on target Japanese-type housing. Recently, the tower has been used for weather and sonic boom research and for conducting tests related to gravity.

Presently, NTS is the site of the Liquified Gaseous Fuels Spill Test Facility, which was completed in 1986 and is located on Frenchman Flat. This facility was constructed for the purpose of conducting tests directed at understanding the physics of spill dispersion, minimizing spill effects, and cleanup technology and procedures.

Area 5 is the location of the low-level Radioactive Waste Management Site (RWMS) where defense waste from various sites across the nation are

disposed. Area 25 is the main support area for the Yucca Mountain Project Office at the NTS. This organization is responsible for the studies to characterize Yucca Mountain for its suitability as a site for the storage of civilian radioactive waste in a deep underground repository. This site straddles 41 square miles of NTS, the Nellis Air Force Gunnery Range, and land controlled by the U.S. Department of Interior, Bureau of Land Management.

3.1.1.2 CTF. The CTF is located in the northern portion of the Idaho National Engineering Laboratory (INEL) (see Figure 2.3-4) on the western edge of the Birch Creek Playa. INEL comprises portions of Jefferson, Bingham, and Butte counties, Idaho, and contains 580,000 acres of federally owned land with restricted access.

The CTF is a scaled (1/5 normal size) version of a commercial pressurized water reactor, originally conceived in 1962 as a single-accident test facility. During construction, however, the CTF project underwent several design changes, and construction was not completed until 1975. The first nuclear loss-of-coolant accident simulation was conducted in the CTF in 1978. This experiment simulated the worst possible type event that could happen in a nuclear reactor and was the first time a pressurized water nuclear reactor system had been subjected to such a major event. Although similar full-scale facilities exist (e.g., in Japan), the CTF is the only nuclear reactor test facility of its size in the world designed to simulate, as closely as possible, all the important events that could occur during loss-of-coolant and other accidents in commercial pressurized water reactor power plants (DOE, n.d.). Over 40 nuclear reactor safety tests were performed at this facility before it was deactivated in 1986; it is currently undergoing asbestos abatement.

The region of influence for population is defined as the portions of 6 counties, Bannock, Bingham, Bonneville, Butte, Jefferson, and Madison, that lie within a 50-mile radius of the CTF, to include the city of Idaho Falls, which is the major population center of the area. Total 1992 estimated population within the region of influence is 146,827.

The region of influence for employment is defined as INEL. Total employment at INEL is 11,600, which includes government and contractor personnel.

INEL was established by the federal government in 1949 to conduct research and further the development of nuclear reactors and related equipment. The CTF is part of the Test Area North (TAN) complex located in the northern portion of INEL (see Figure 2.3-5). TAN was originally established in the 1950s to support the U.S. Air Force and Atomic Energy Commission Aircraft Nuclear Propulsion Program. Facilities at TAN include an Initial Engine Test Facility, a Technical Support Facility, and a Water

Reactor Research Facility, as well as the CTF. A four-rail railroad track connects the Initial Engine Test Facility and CTF areas to the Technical Support Facility.

More than 50 reactors have been built at INEL, of which 14 are still in operable status. Major facilities at the INEL are operated by Argonne National Laboratory-West (ANL-W), EG&G Idaho, Babcock and Wilcox - INEL, Westinghouse Electric Corporation, and Westinghouse Idaho Nuclear Company.

The major facilities that support INEL programs (Figure 2.3-4) include the following (DOE, 1991a):

- **Naval Reactors Facility (NRF):** Ship propulsion reactors and training facilities
- **Test Reactor Area (TRA):** Nuclear reactor fuel and materials testing; nuclear electronics research and development programs.
- **Idaho Chemical Processing Plant (ICPP):** Fuel receiving and storage, fuel processing, and waste management.
- **Central Facilities Area (CFA):** Support services including transportation, large shops, health services, and radiation monitoring.
- **Power Burst Facility (PBF):** Reactor used for thermal fuels behavior studies now in stand by mode; low-level radioactive waste reduction.
- **Auxiliary Reactor (ARA):** Materials testing, environmental monitoring, and hot cell operation, presently in the mothball stage.
- **Argonne National Laboratory-West (ANL-W):** Breeder reactor research and development.
- **Radioactive Waste Management Complex (RWMC):** Waste examination and certification, storage of retrievable transuranic waste, permanent disposal of low-level beta-gamma waste.

3.2 INFRASTRUCTURE

Infrastructure includes sources and supplies of electricity, solid waste disposal, wastewater disposal, and water. The region of influence for each component of infrastructure is the source that would supply the utility to each alternative site, as well as the system used to connect the source to the alternative site.

3.2.1 SMTS

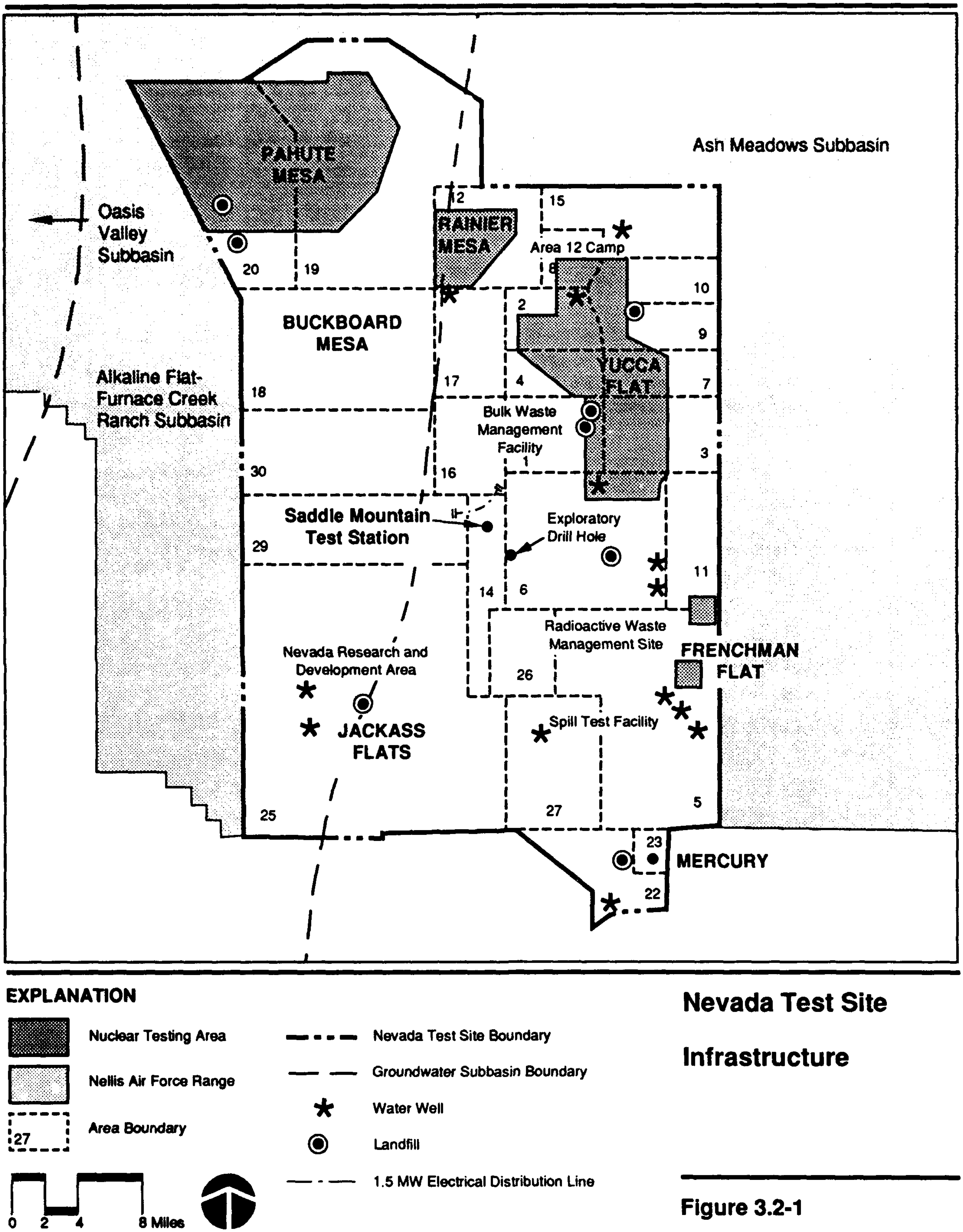
3.2.1.1 Energy. NTS uses commercial power provided by the Nevada Power Company over a 55-megawatt (MW) line rated at 138 kilovolts (kV). This line is 25 years old and in fair to good condition with minimal outages. Transmission and distribution systems with sufficient capacity to handle existing energy requirements are in place throughout the NTS Complex and closely parallel the road network on NTS. There is no distribution line to the SMTS. An existing distribution line located 2.4 miles to the north has a capacity of 1.5 MW.

3.2.1.2 Solid Waste. Eight landfills are available for the disposal of nonradioactive, nonhazardous solid wastes. The state of Nevada requires that landfill Operation and Maintenance Plans be approved, but does not require permits. All landfills currently operating at NTS have plans that were approved by the state.

The NTS disposal sites include construction and sanitary landfills or trenches in Areas 3, 6, 20, 23, and 25, and a subsidence crater used as a landfill in Area 9. These landfills, with the exception of the subsidence crater and the Area 6 landfill, contain municipal and construction waste only. The subsidence crater is used for construction wastes including dirt, sewage sludge, and asbestos. The Area 6 landfill is approved by the state of Nevada for disposal of hydrocarbon-contaminated waste (debris and soils). The landfills in Areas 3, 10, and 23 are anticipated to be operational for an additional 10 years. The landfills in Areas 20 and 25 are anticipated to be operational for an additional five years. The landfill in Area 6 has approximately four years of site life still available. Landfills in Areas 3, 6, 20, and 25 are temporarily closed. Two other landfills, in Areas 3 and 20, are used for drilling mud disposal. There are no active solid waste collection points at the SMTS. Landfills near the SMTS are located in Areas 3, 6, and 25.

3.2.1.3 Wastewater. Wastewater at NTS is treated by various means ranging from treatment plants with primary and secondary capabilities to on-site septic systems. No sanitary treatment facilities currently exist at the SMTS. NTS is not required to have National Pollution Discharge Elimination System (NPDES) permit

3.2.1.4 Water Supply. Groundwater is the only local source of water at NTS. Drinking and industrial water for NTS are produced from supply wells tapping four aquifers. Eleven NTS wells currently withdraw water from the Ash Meadows subbasin and two withdraw from the Alkaline Flat-Furnace Creek Ranch Subbasin. These wells provide water for construction, drilling, fire protection, and consumption uses which total 695 million gallons per year (Figure 3.2-1). Permitting of these wells is not required under state water laws; however, the water system has several permits in place from



Nevada Test Site Infrastructure

Figure 3.2-1

the state of Nevada which require monthly bacteria sampling. Data collected from wells located in Areas 2, 5, and 6 of NTS indicate that there has been no detectable decline in static water level; therefore, consumption does not exceed yield for the Ash Meadow subbasin. Total withdrawals from two of these wells (C and C-1) in Area 6 average 0.07 million gallons per day (MGD). Wells in Areas 5, 6, and 25 supply approximately 0.86 MGD of groundwater to NTS facilities. The nearest water source to the SMTS is an existing 3,680-foot-deep, large-diameter exploratory drill hole located near the axis of Mid Valley, approximately 2.1 miles southeast of the SMTS (see Figure 3.2-1). This source is currently not used for water supply purposes.

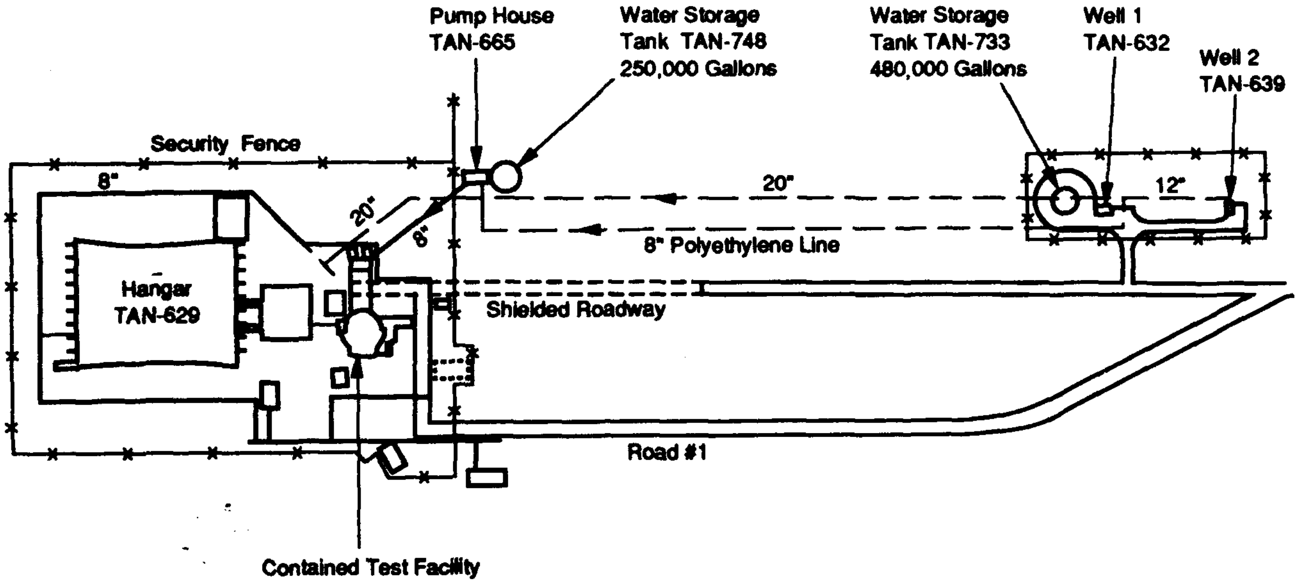
3.2.2 CTF

3.2.2.1 Energy. Power service to INEL is provided by an extensive electrical transmission/distribution system composed of 56.5 miles of 138 kV transmission line, 122.6 MW transformer capacity, and seven major substations. INEL currently uses approximately 40 MW for heating and power. Power supplied to INEL is received from two sources: the Idaho Power Company, and the on-site Experimental Breeder Reactor II, operated by ANL-W. INEL has a 10-year contract with the Idaho Power Company for electrical energy, which expires in October 1996. It allows for an increase of power up to 55 MW with advance notice. Approximately 60 percent of the power required for site operations is provided from the Idaho Power *Company, with the remainder generated on site by the Experimental Breeder* Reactor-II. The CTF receives electricity from the Idaho Power Company. The capacity of existing transformers at TAN, which also supply the CTF, is 120 MW. Existing demand for these sites is 30 MW.

3.2.2.2 Solid Waste. Municipal and construction solid wastes generated at the CTF are separated and disposed. Municipal wastes are disposed of in the Central Facilities Area landfill, permitted by the state of Idaho. Construction or industrial solid wastes are disposed of in pits at INEL. Disposal pits for construction waste at INEL do not require permits.

3.2.2.3 Wastewater. Nonradioactive, nonhazardous liquid effluent streams are discharged into percolation ponds, evaporation ponds, or sewage treatment facilities, depending on the nature of the wastewater. The wastewater system used at the CTF includes a 4,000-gallon septic tank connected to a 16-million-gallon lagoon. The facilities are permitted by the state of Idaho. No NPDES permits are required.

3.2.2.4 Water Supply. Water wells at INEL tap the Snake River Aquifer, which contains an estimated one billion acre-feet of water. INEL is permitted to pump 52 MGD from 27 existing production wells and currently pumps up to 6 MGD depending on facility needs (Figure 3.2-2).



EXPLANATION

- - - Raw Water

——— Fire Water

Idaho National Engineering Laboratory

Water Wells at CTF

Figure 3.2-2

The existing CTF water systems provide a source of water for the CTF integral test system, storage, pumping, distribution piping for fire protection purposes, and a source of water for interfacing systems such as service water and domestic water. The domestic water system at the CTF supplies the demand for hot and cold water for showers, lavatories, sinks, and other fixtures. The service water system supplies water for cooling heat exchangers, softened and demineralized water systems, pump seals to prevent outleakage of fluids, and various washing and flushing operations.

Water pumping and storage facilities, located approximately 1,200 feet east of the main CTF area, consist of the following:

- Two pumphouses (TAN-632 at Well Number 1 and TAN-639 at Well Number 2), each with one pump with pumping capacity of 1,000 gallons per minute (1.44 MGD). The water table is approximately 200 feet deep; the wells are 340 feet and 461 feet deep. Each has been tested to discharge flows up to 3,000 gallons per minute (4.32 MGD). The system can be aligned for the well pumps to discharge into a 480,000-gallon storage tank next to Well Number 1 or a 250,000-gallon storage tank northeast of the CTF (described below).

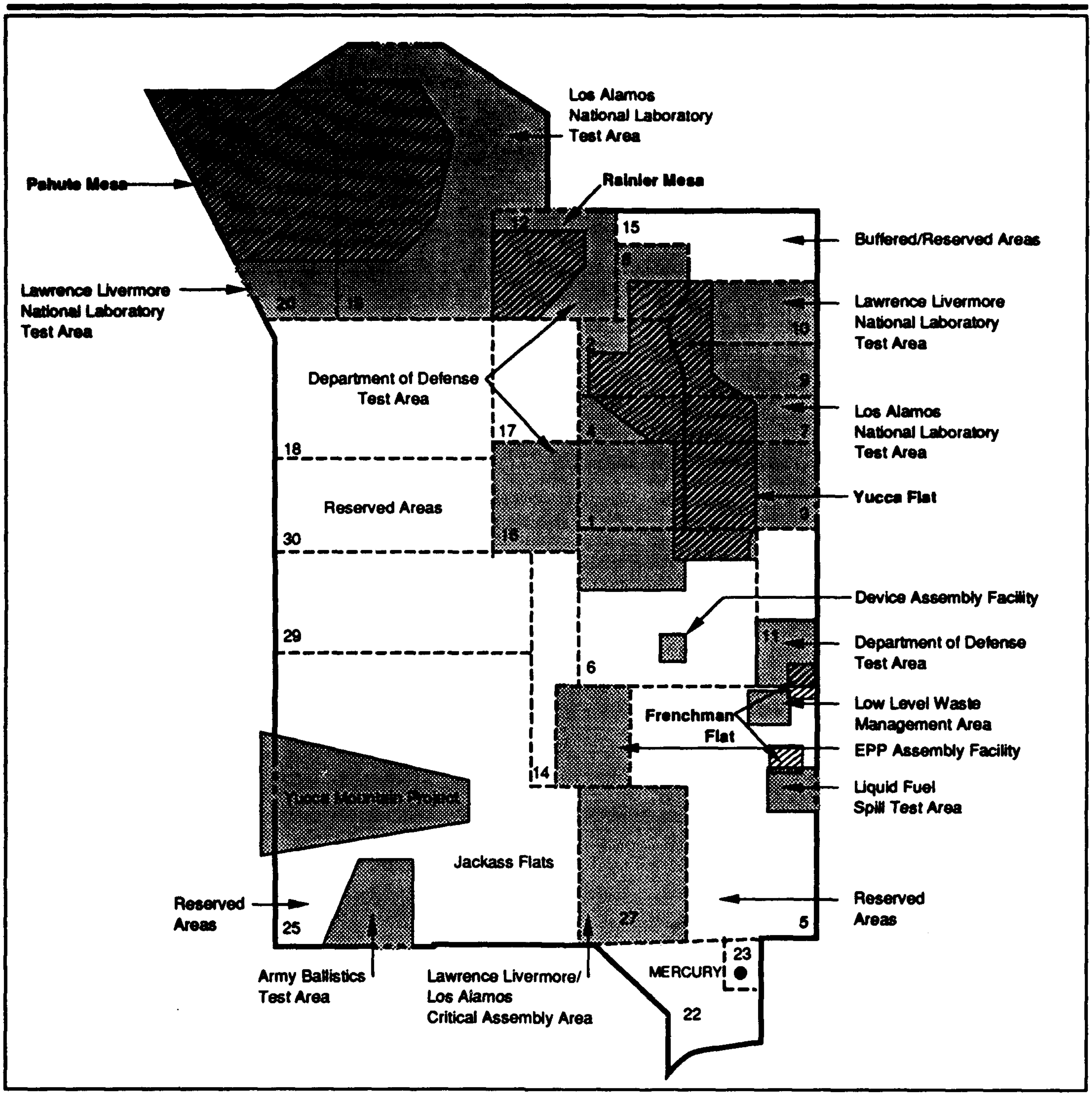
- A 250,000-gallon water storage tank and pumphouse were installed approximately 350 feet northeast of the CTF reactor area in 1980, to provide a redundant water supply for fire protection and both domestic and service water demands. A diesel-powered pump, rated at 1,500 gallons per minute (2.16 MGD), discharges directly into the fire hydrant piping system that surrounds the CTF area.

3.3 LAND USE

The land use resource for this program considers whether the current and projected land use at the alternative sites is compatible with implementation of the Proposed Action. The region of influence for this resource is the immediate vicinity of the alternative sites. To provide context, the general land uses of the two installations are also described.

3.3.1 SMTS

Land within NTS is used exclusively for national defense and energy-related purposes by DOE and is not open to public use for any purposes, such as agriculture, mining, homesteading, or recreation. The principal land use areas of NTS are shown in Figure 3.3-1. The installation is separated into land areas dedicated to nuclear research and development, testing and development of nuclear weapons, studies to determine effects of radioactivity, disposal of low-level waste, and logistics support for nuclear research and development projects. Nuclear testing activities at NTS have



EXPLANATION

Nevada Test Site Boundary

27 Area Boundary

Area Assigned to Designated User

Nuclear Weapons Testing Areas

0 2 4 8 Miles

Nevada Test Site

Land Use Areas and Existing Designated Land Users

Figure 3.3-1

included atmospheric and underground tests of nuclear explosives in Areas 2, 3, 4, 5, 7, 9, 10, 12, 19, and 20. At present, tests are conducted at Yucca Flat, Rainier Mesa, and Pahute Mesa. Testing of nuclear reactors, nuclear engines, and nuclear furnaces have been conducted at the Nevada Research and Development Area located in Jackass Flats.

Area 5 contains the RWMS for the disposal of low-level waste generated by several DOE facilities. A full range of site-support activities include the central control point for nuclear test operations in Area 6, the northern camp area in Area 12, and Mercury in Area 23 on the southern end of NTS. Billeting is available at Mercury.

A small portion of Area 14 approximately 3 miles north of the SMTS was previously used for solid propellant testing. The SMTS site is undeveloped and is reached by unimproved dirt roads.

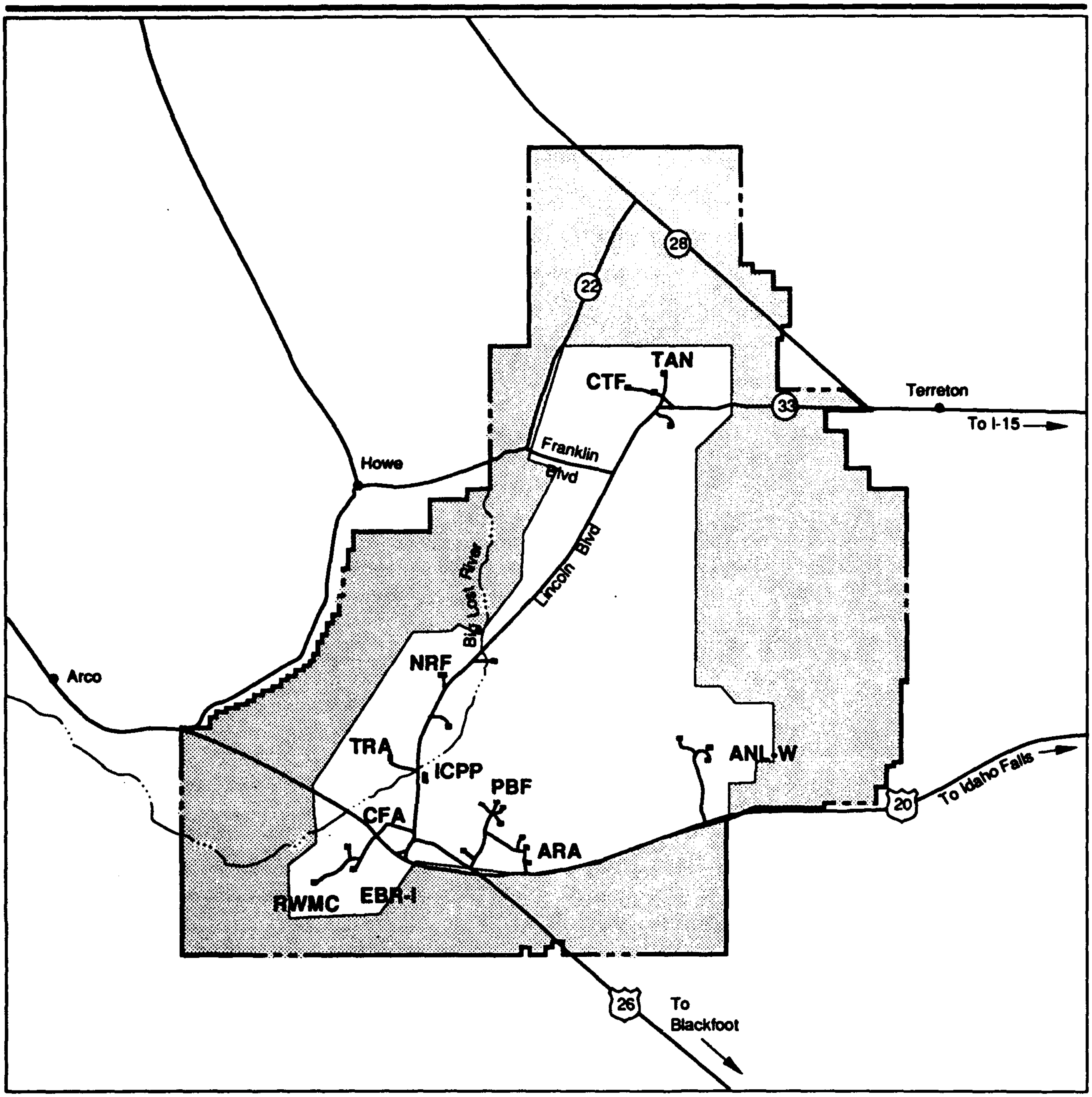
As discussed in Section 3.1.1.1, Area 25 includes the Yucca Mountain area, which is undergoing site characterization for a high-level radioactive waste repository. Site studies for this activity are governed by 10 CFR 960, General Guidelines for the Recommendation of Areas for Nuclear Waste Repositories.

3.3.2 CTF

INEL operates as a DOE multi-program installation. The primary function of INEL is to conduct research on nuclear reactors and related equipment. Unlike NTS, INEL does not categorize the land uses on the installation by functional area. There are two distinct land uses on INEL: research and development, and grazing area (Figure 3.3-2). Within the research and development land use, 11 facilities/areas are dedicated to specific programs. Each facility is separated by large open spaces that provide appropriate buffer and safety zones between the facilities. The grazing area has been established by DOE permit as a safety buffer between the test areas and public lands. INEL maintains the authority to restrict grazing during operational activities.

The facility site areas (see Figure 3.3-2) contain programs that support the INEL function; examples of facilities/activities are ship propulsion reactors and training facilities, materials testing, breeder reactor research and development, and disposal of radioactive waste.

The CTF site was originally constructed as an operational test facility, and is functionally part of the TAN complex. The CTF site represents less than 0.01 percent of the total land area of INEL (see Figure 3.3-2). Facility structures include the Containment and Service Building, the Control and Equipment Building, and other support facilities. A specially designed railroad flatcar is available to transport mobile reactor assemblies into and



EXPLANATION

Research and Development

Grazing Area

INEL Boundary

0 2 4 8 Miles

ANL-W - Argonne National Laboratory West
ARA - Auxiliary Reactor Area
CFA - Central Facility Area
CTF - Contained Test Facility
EBR-I - Experimental Breeder Reactor-I
ICPP - Idaho Chemical Processing Plant
NRF - Naval Reactors Facility
PBF - Power Burst Facility
RWMC - Radioactive Waste Management Complex
TAN - Test Area North
TRA - Test Reactor Area

Idaho National Engineering Laboratory

Principal Land Use Areas

Figure 3.3-2

out of the containment vessel. Systems for operating and monitoring the reactor are located inside structures immediately adjacent to the containment vessel. The CTF is currently undergoing asbestos abatement.

3.4 TRANSPORTATION

Transportation includes those aspects of roadways that would be used by program employees and to support operational requirements at the alternative sites and includes airspace considerations at the alternative sites. The region of influence for roads is the installation road network as well as major roads connecting the installation with nearby communities; the airspace regions of influence for the SMTS is NTS and adjoining Nellis Range, and for the CTF is INEL.

3.4.1 SMTS

3.4.1.1 Transportation. Access to the SMTS is provided by unpaved, gravel roads (see Figure 2.3-2). Mid Valley Road, connecting SMTS with Pahute Mesa Road to the north and with Cane Springs Road to the south, is a narrow gravel road. Mine Mountain Road to the east of the SMTS is a two-lane gravel road providing access from Mercury Highway. Saddle Mountain Road is a two-lane gravel road to the south of the SMTS, providing access from Lathrop Wells Road and the Nevada Research and Development Area. During underground testing, both Mine Mountain Road and Saddle Mountain Road may be blocked for access.

Access to NTS is controlled at all times. The access for all construction materials would be via U.S. 95 and Mercury Highway. Mercury Highway is a paved, two-lane road that runs north-south on the east side of the site, connecting to U.S. 95 at the southeastern end of NTS. Mercury Highway is used by the majority of traffic traveling to existing test sites and support sites, with the primary access gate to NTS located approximately one mile north of the junction with U.S. 95. A second access point on Mercury Highway, located in the northeastern corner of NTS, can be reached from State Route 375, approximately 21 miles northeast of the NTS boundary. Lathrop Wells Road on the southwest corner of NTS provides access from U.S. 95.

U.S. 95 and Mercury Highway provide the only public access to NTS. From Las Vegas to the junction with Mercury Highway, U.S. 95 is a four-lane, divided highway, with an annual average daily traffic (AADT) volume of 3,400 vehicles. Peak hour (6:30 a.m. to 8:00 a.m. and 4:30 p.m. to 6:30 p.m.) traffic volume at the Mercury Highway Junction 13 is approximately 550 vehicles. West of the Mercury Highway Junction, U.S. 95 is reduced to two lanes, and has an average traffic volume of 2,535 AADT.

Approximately 5,000 commuting employees use their private automobiles, travel in car pools, or ride in chartered buses to and from work. Approximately 100 buses operate from Las Vegas to NTS on a daily basis.

3.4.1.2 **Airspace.** The airspace overlying NTS and the adjoining Nellis Range is referred to as the Nellis Range Complex. All the airspace within the complex is restricted. This restricted area is set aside by the Federal Aviation Administration to accommodate activity that presents a hazard to non-participating aircraft, either military or civilian. These areas within the Nellis Complex are designated geographically and vertically to ensure safe separation of aircraft. Also, the air traffic control of the ranges is provided by Nellis Air Force Base in coordination with DOE at NTS.

3.4.2 CTF

3.4.2.1 **Transportation.** Ninety miles of paved U.S. and state highways cross through INEL (see Figure 2.3-4). U.S. 20 and 26 pass through the southern portion of INEL. Average traffic volume on U.S. 20 at the junction with U.S. 26 is 2,290 AADT, with peak hour traffic of 400 to 450 vehicles. Average traffic volume on U.S. 26 at this junction is 1,050 AADT. State Highways 22, 28, and 33 pass through the northern portion of INEL. These highways are open to the public. Access to the interior portions of the INEL facilities is controlled at check points manned by security guards.

The CTF is located at the end of Snake Avenue in the northern portion of INEL, approximately two miles from the intersection of Lincoln Boulevard and State Route 33. State Route 33 connects with Interstate 15 approximately 25 miles north of Idaho Falls. Average traffic volume on Highway 33 at the intersection of Highway 28 is 530 AADT. Lincoln Boulevard, which is not open to the public, is the main road that connects the CTF to the southern portion of INEL, and to U.S. 20. The distance from the CTF to U.S. 20 is approximately 28 miles.

Commuting employees are transported from their communities to INEL by approximately 130 passenger buses. These buses transport 4,000 to 5,000 employees daily and run on regular schedules from the surrounding communities of Arco, Pocatello, Blackfoot, Idaho Falls, Rigby, Rexburg, Shelley, and Mackay. The remainder of the employees commute using private vehicles or work in Idaho Falls.

INEL occasionally requires the closure of public roads to transport high activity or large size loads from site to site. A typical scenario during the mid-1970s to early 1980s was the transportation of a large irradiated materials shipment cask that required the closure of 17 miles of U.S. 20 in order to safely move it from the Test Reactor Area to ANL-W. Closures of public roads in such instances are negotiated with the state of Idaho and closure plans implemented. For large cask shipments, approval of the State

of Idaho Transportation Department was obtained in the transportation plan document and in the oversize load permit.

3.4.2.2 Airspace. The airspace around INEL is designated by Federal Aviation Regulation as a National Security Area. Flights below 6,400 feet mean sea level (MSL) are prohibited. The elevation of the CTF is approximately 4,800 feet MSL. Therefore, no aircraft will be closer to the ground than approximately 1,600 feet.

3.5 HAZARDOUS MATERIALS AND HAZARDOUS WASTE MANAGEMENT

Hazardous materials and hazardous waste management activities at both the SMTS and the CTF are governed by specific environmental regulations. For the purpose of the following analysis, the terms hazardous waste and hazardous materials mean those substances defined as hazardous by the Comprehensive Environmental Response Compensation and Liability Act, 42 U.S. Code (USC) §9601-9675, as amended, and the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA), 42 USC §6901-6992, as amended. In general, this includes substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare or the environment when released.

Transportation of hazardous materials is regulated by Department of Transportation regulations within Chapter 49 of the Code of Federal Regulations (CFR). In the states of Nevada and Idaho these regulations are not supplemented by state statute or regulation.

All fuel fabrication and fuel assembly operations would be performed by a commercial vendor. For a conservative estimate, Lynchburg, Virginia (the most distant possible source of fuel) is used to determine shipping distance. The vendor would package these PBR fuel elements into a criticality-safe configuration and provide a shipping container suitable for over-the-road shipments. DOE would assume accountability for the nuclear fuel material at the point of fabrication and provide safe, secure transportation to the proposed testing location.

All radioactive waste materials generated during PBR validation testing activities are expected to meet the acceptance criteria for low-level wastes (LLW). Related functions associated with both preparations for testing and post-test activities could generate a small volume of mixed wastes. To show how the SNTP waste management program relates to the general waste management requirements applicable to all DOE facilities, the following discussion includes consideration of waste classifications other than those anticipated as a result of the proposed action. DOE Order 5820.2A (Radioactive Waste Management) defines six materials

classifications of concern in managing radioactive wastes. Installation specific information is provided in sections 3.5.1 and 3.5.2.

NTS and INEL operate under Waste Minimization and Pollution Prevention Awareness Plans (DOE, 1991e, 1992b, 1992d). These plans identify waste management techniques, implement minimization procedures, and develop site-wide goals pursuant to DOE Orders 5400.1, 5400.3, 5820.2A, and RCRA. To this end, NTS and INEL are committed to eliminate or reduce the total amount of hazardous waste they generate.

In November 1989, the Secretary of Energy established the United States Department of Energy Office of Environmental Restoration and Waste Management (EM) for the purpose of consolidating DOE environmental restoration and waste management activities. Ongoing and future studies related to the DOE-wide EM program discussed in Section 2.7 may modify the waste management procedures and restoration activities; however, capabilities are not expected to change significantly.

High-Level Waste (HLW): HLW is produced only during the reprocessing of spent nuclear fuel. It has been determined that the fuel elements irradiated during PBR validation testing activities would be of negligible economic value considering the cost of recovery. Since the material would not be reprocessed, HLW could not be generated.

Transuranic (TRU) Waste: TRU wastes contain concentrations greater than 100 nanocuries per gram of alpha-emitting radionuclides with atomic numbers greater than 92 and radioactive half-lives longer than 20 years. Under the projected PBR validation test conditions, the maximum concentration of TRUs will not exceed 80 nanocuries per g[illegible] Consequently, there will be no TRU wastes generated in association with the proposed action; however, to provide a complete evaluation of the existing environmental conditions, the capabilities for managing TRU waste are discussed in site specific sections, and associated transportation analyses are presented in Appendix E.

Spent Nuclear Fuel: Spent nuclear fuel is defined as any fuel material permanently withdrawn from a reactor after irradiation which is essentially complete or intact. This broad definition does include the fuel materials irradiated during PBR validation testing activities; however, the hazards resulting from the proposed action are very low when compared to that associated with spent nuclear fuel resulting from the production of either power or plutonium. The DOE Order provides that fissionable materials irradiated only for research and development (i.e., not for production of power or plutonium) and containing less than 100 nanocuries per gram of TRUs may be treated as low-level waste.

Because the spent nuclear fuel materials removed from the PBR validation test facility meet the criteria of the DOE Order, it is the intent of the SNTP program to dispose of the material as LLW in disposal facilities currently available at each of the candidate sites. Ultimate disposition of these materials, as well as other LLW, is discussed in Sections 4.5.1 and 4.5.2 for NTS and INEL, respectively. The relatively low hazards associated with these materials do not warrant displacement of very limited volumes which will become available in extremely expensive repositories designed for the far more hazardous commercial spent nuclear fuels. In the event that such disposal is not feasible, both facilities have the capability to store (not dispose of) the material as "spent nuclear fuel" until such time as DOE procedures and requirements for disposing spent nuclear fuel have been defined. *Due to the relatively low hazards associated with these materials* as compared to commercial spent nuclear fuels and the projected limited volumes available for the commercial spent nuclear fuels, the irradiated fuels resulting from the proposed action may not satisfy the acceptance criteria for materials to be placed into depositories developed for spent commercial fuels.

Byproduct Material: Byproduct material is any radioactive material (except special nuclear material) yielded in, or made radioactive by, the production or utilization of special nuclear material. As applied to the proposed action, this would include activated or contaminated material such as structural components of the test facility. The quantities of this material expected to be generated during PBR validation testing activities would be treated as low-level waste.

Low-Level Waste (LLW): LLW is defined as any radioactive waste not classified as high-level waste, transuranic waste, spent nuclear fuel, or *by-product material.*

Mixed Waste: Mixed waste is any of the above which also contain nonradioactive hazardous waste components defined by the Resource Conservation and Recovery Act (RCRA). While not expected, there is some probability that small volumes of such mixed waste could be generated during either preparation for testing or post-testing activities associated with PBR validation activities. Mixed waste that could be expected to be generated during the proposed action would result from maintenance and clean-up operations, preparation of test samples for PIE, and activities associated with installation and maintenance of instrumentation and controls.

Treatment and disposal of nonhazardous waste, including wastewater, is discussed as part of infrastructure support in Section 3.2.

No contaminated liquids are expected to be generated during the proposed *action; however, an approved methodology for treating radioactively*

contaminated process liquids currently exists at each alternative testing location. These treatment processes involve separation of the radioactive material from the liquid, solidification of the resulting sludge, and eventual disposal as low-level waste.

The regions of influence for management of hazardous materials or hazardous wastes from the SMTS and the CTF are NTS and INEL, respectively, since site-wide programs are currently in place.

3.5.1 SMTS

3.5.1.1 Hazardous Materials Management. Hazardous materials at NTS are controlled and managed from the point of purchase through disposal by hazardous material accountability systems. No hazardous materials are known to be present at the SMTS site due to the undeveloped nature of the area.

3.5.1.2 Nonradioactive Hazardous Waste. Hazardous wastes generated at the NTS are managed in accordance with the provisions of RCRA. The Department of Energy, Nevada Field Office (DOE/NV) reports all RCRA generator activities under its identification number NV 389 009001 (DOE, 1990d). Up to 55 gallons of these wastes are collected at local testing facilities and are then transferred to the Area 5 Hazardous Waste Accumulation Pad. Within 90 days of arrival at the Hazardous Waste Accumulation Pad, the wastes are sent for ultimate disposal at an EPA-approved off-site Treatment, Storage or Disposal Facility. Approximately 3,500 cubic feet of hazardous waste are generated from NTS activities each year.

Because the area is undeveloped, no hazardous waste is being generated at the SMTS site.

3.5.1.3 Radioactive Hazardous Waste. Existing waste handling facilities at NTS are located at the Radioactive Waste Management Site (RWMS) in Area 5 and the Bulk Waste Management Facility (BWMF) in Area 3. The RWMS is used for LLW disposal, mixed waste disposal, TRU waste storage, hazardous waste accumulation, and disposal of classified material. Bulk LLW is disposed of at the BWMF. The NTS Waste Minimization Plan (DOE, 1990e, 1991e) and Waste Acceptance Criteria (DOE, 1988f) establish waste management techniques and minimization procedures for radioactive wastes.

The NTS RWMS has implemented acceptance criteria, certification, and transfer requirements for wastes to be stored and/or disposed of at NTS (DOE, 1988f). This document establishes procedures to be followed by waste generators for waste streams approval, waste classification, packaging, etc.

Low-Level Waste (LLW)

The estimated remaining capacity for solid LLW at NTS is approximately 17.7 million cubic feet (20 years) with an estimated annual input of 880,000 cubic feet (DOE, 1990f).

Mixed Waste

To provide disposal capacity for mixed waste, the DOE/NV has obtained interim operating status for a Mixed Waste Management Unit (MWMU) at the RWMS. DOE/NV has applied for an RCRA Part B permit from the state of Nevada for disposal of mixed waste (DOE, 1990f). As of 1989, approximately 200,000 cubic feet of mixed waste had been disposed of at NTS. The MWMU is to be operable for five years from Part B permit issuance or until 5.3 million cubic feet of mixed waste has been accumulated, whichever comes first. Following permit issuance, the expected annual input of mixed waste to the MWMU is approximately 700,000 cubic feet. Additional mixed TRU waste can be stored at the RWMS if DOE applies for and obtains an RCRA permit.

Transuranic (TRU) Waste

TRU wastes are stored in a TRU storage pad at the RWMS in preparation for eventual transfer to the Waste Isolation Pilot Plant (WIPP) in New Mexico (DOE, 1980). The current volume of TRU waste stored at the RWMS is approximately 21,000 cubic feet; the estimated remaining capacity of the TRU storage pad is approximately 35,000 cubic feet (DOE, 1990f).

3.5.1.4 Environmental Restoration. Environmental restoration activities currently proceeding at NTS include closure activities for steam cleaning effluent ponds and closure of the Decontamination Facility evaporation pond (Area 6); closure, temporary closure, or removal of underground storage tanks (Areas 12, 23, and 25); and disposal of wastes from NTS tunnels (Areas 5 and 12). The SMTS is not known to contain any hazardous waste sites due to its undeveloped nature.

3.5.2 CTF

3.5.2.1 Hazardous Materials Management. Hazardous materials at INEL are controlled and managed from the point of purchase through disposal by hazardous material accountability systems at each facility.

3.5.2.2 Nonradioactive Hazardous Waste. More than 30 areas at INEL generate RCRA-regulated hazardous waste. Hazardous waste is temporarily stored at the Hazardous Waste Storage Facility, which is permitted to have a total storage capacity of 2,280 cubic feet, and maximum allowable annual throughput of 16,980 cubic feet. The current annual average throughput is

3,250 cubic feet. Hazardous waste is held at this site prior to regular off-site shipment for final disposal at licensed RCRA facilities.

The Waste Reductions Operations Complex (WROC) manages the Hazardous Waste Storage Facility (HWSF), Mixed Waste Storage Facility (MWSF), and the landfills. Although WROC can manage all hazardous waste on INEL, several of the INEL contractors (e.g., Argonne National Laboratory, Westinghouse Electric Company, and Westinghouse Idaho Nuclear Company) have elected to manage their own hazardous waste. WROC manages the remainder of the material generated by EG&G Idaho, Babcock and Wilcox, and Protection Technology of Idaho.

The CTF is being maintained in standby status; therefore, hazardous waste currently is not being generated. Some removal of asbestos, including removal of asbestos gaskets, floor tile and mastic, ceiling tile, and pipe/duct insulation, is being accomplished with disposal to a permitted hazardous waste management facility for eventual permanent disposal.

3.5.2.3 Radioactive Hazardous Waste. The Radioactive Waste Management Complex (RWMC) is a storage and disposal facility intended primarily for radioactive materials from defense and nuclear energy research programs. The RWMC is located in the southwest corner of INEL (see Figure 3.3-2).

Low-Level Waste (LLW)

Solid LLW is disposed of in an active portion of the fenced Subsurface Disposal Area located in the western part of the RWMC. The Subsurface Disposal Area contains pits, trenches, and vaults excavated into the basalt. The total volume of waste disposed of in the Subsurface Disposal Area is about 3.7 million cubic feet; about 80,000 to 102,000 cubic feet of solid LLW is disposed annually. An environmental monitoring program continuously evaluates impacts of current operations and is used to predict impact of proposed additions and/or modifications to the facility.

In accordance with applicable DOE orders, LLW may include a TRU component of less than 100 nanocuries per gram. As a performance goal, the RWMC at INEL currently disposes of LLW with a TRU component of 10 nanocuries per gram or less. LLW with TRU concentrations between 10 and 100 nanocuries per gram is held in storage at RWMC for other disposal options.

Mixed Waste

Mixed wastes are handled at the MWSF at WROC. These wastes are stored on an interim basis until shipped to an EPA-approved off-site Treatment, Storage, or Disposal Facility.

Transuranic (TRU) Waste

TRU waste is packaged at the individual facilities that generate this waste, then kept in retrievable storage at the Transuranic (waste) Storage Area. The Transuranic Storage Area consists of asphalt storage pads for contact-handled TRU waste; each pad can store 1.4 million cubic feet of waste. Pads are constructed as required and sufficient room exists inside the current Transuranic Storage Area boundaries for 16 waste storage pads with a total storage capacity of 21 million cubic feet. As of 1988, 2.3 million cubic feet of TRU waste was in storage at this facility. The TRU waste storage capacity is adequate to store INEL baseline projected waste volumes until shipment to the WIPP or another designated facility.

3.5.2.4 Environmental Restoration. In November 1989, the Secretary of Energy established the United States Department of Energy Office of Environmental Restoration and Waste Management (EM) for the purpose of consolidating DOE environmental restoration and waste management activities. The existing EM Program primarily resolves environmental restoration and waste management activities on a site-by-site basis. Section 2.7 discusses the study being conducted on environmental restoration and waste management by the DOE.

The National Contingency Plan and Superfund Amendments and Reauthorization Act (SARA) of 1986 identify the procedures to be followed when addressing any hazardous waste sites. Since SARA was passed, most federal facilities have been placed on a federal docket and the EPA has been evaluating the facilities' waste sites for possible inclusion on the National Priorities List (NPL).

INEL was placed on the NPL in 1989 to facilitate cleanup and monitoring of contaminated areas. An injection well located at TAN, in close proximity to the CTF, is one of the NPL contaminated sites. Disposal of liquid effluent generated by operations at TAN into a well between 1955 and 1972 resulted in small accumulations of two volatile organic compounds along with small amounts of low level radioactive contamination in the sediments. Concentrations of trichloroethylene at one point exceeded the EPA maximum contaminant level in drinking water. Removal of a 60-foot column of sediment in the former injection well was completed in 1990. An aeration system was installed to remove trichloroethylene from the water before it reaches the distribution system and the drinking water is monitored monthly to ensure that concentrations remain at safe levels.

3.6 AIR QUALITY

Air quality in a given location is described as the concentration of various pollutants in the atmosphere, generally expressed in parts per million or micrograms per cubic meter. Air quality is determined by the type and

amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The significance of a pollutant concentration is determined by comparing it to federal and/or state ambient air quality standards. These standards represent the maximum allowable atmospheric concentrations that may occur and still protect public health with a reasonable margin of safety. Federal standards are established by the EPA and are called National Ambient Air Quality Standards (NAAQS) (Table 3.6-1). The pollutants considered in this analysis are ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), and particulate matter less than 10 microns in diameter (PM_{10}). No operations have been identified which would cause the emission of airborne lead (Pb); therefore, no further consideration is given to this pollutant.

In general, the region of influence is the regional air quality basin within which the proposed site locations occur.

The Clean Air Act (CAA) requires that project emission sources comply with the air quality standards and regulations that have been established by federal, state, and local regulatory agencies. Standards and regulations focus on (1) the maximum allowable ambient pollutant concentrations resulting from project emissions, both separately and combined with other surrounding sources, and (2) the maximum allowable emissions from the project. According to EPA requirements, an area with air quality better than the NAAQS is designated as being in attainment; areas with worse air quality are classified as nonattainment areas. A nonattainment designation is given to a region if the primary NAAQS for any criteria pollutant is exceeded at any point in the region; the state may also designate areas as either in attainment or nonattainment.

The Prevention of Significant Deterioration (PSD) program (CAA Subchapter 1 Part C Sections 160-169) requires an owner or operator to obtain a permit before construction of a major new source or major modification of certain existing sources located in an attainment or unclassified area. A major stationary source, as defined by the PSD regulations, is any source belonging to a list of 28 specified categories that has the potential to emit 100 tons per year or more of any pollutant regulated under the CAA. Potential to emit is based on the maximum design capacity of a source and takes into account pollution control efficiency. Sources not on the list of 28 categories are considered major if they have potential emissions of 250 tons per year or more of any pollutant regulated under the CAA. Once an existing source is considered major, PSD review is required if the modification to the source results in a net increase in pollutants in significant amounts.

Under the PSD, increments and ceilings have been established for areas (known as Class I, II, or III areas) throughout the United States. Class I

Table 3.6-1. National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary (Health Related) Averaging Time	Primary Standard Level Concentration[a]	Secondary (Welfare Related) Averaging Time	Secondary Standard Level Concentration
PM_{10}	Annual Arithmetic Mean[b]	50 $\mu g/m^3$		Same as Primary
	24-hour[b]	150 $\mu g/m^3$		Same as Primary
SO_2	Annual Arithmetic Mean	(0.03 ppm) 80 $\mu g/m^3$	3-hour[c]	1,300 $\mu g/m^3$ (0.50 ppm)
	24-hour[c]	(0.14 ppm) 365 $\mu g/m^3$		
CO	8-hour[c]	9 ppm (10 mg/m^3)		No Secondary Standard
	1-hour[c]	35 ppm (40 mg/m^3)		No Secondary Standard
NO_2	Annual Arithmetic Mean	0.053 ppm (100 $\mu g/m^3$)		Same as Primary
O_3	Maximum Daily 1-hour Average[d]	0.12 ppm (235 $\mu g/m^3$)		Same as Primary
Pb	Maximum Quarterly Average	1.5 $\mu g/m^3$		Same as Primary

Notes: (a) Parenthetical value is an approximately equivalent concentration.
(b) TSP was the indicator pollutant for the original particulate matter (PM) standards. This standard has been replaced with the new PM_{10} standard and it is no longer in effect. New PM standards were promulgated in 1987, using PM_{10} (particles less than 10μ in diameter) as the new indicator pollutant. The annual standard is attained when the expected annual arithmetic mean concentration is less than or equal to 50 $\mu g/m^3$, the 24-hour standard is attained when the expected number of days per calendar year above 150 $\mu g/m^3$ is equal to or less than 1, as determined according to Appendix K of the PM NAAQS.
(c) Not to be exceeded more than once per year.
(d) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is equal to or less than 1, as determined according to Appendix H of the Ozone NAAQS.

mg/m^3 = milligrams per cubic meter
$\mu g/m^3$ = micrograms per cubic meter
ppm = parts per million

areas have been identified primarily to monitor and protect air quality near certain national parks, wilderness areas and monuments. Class II areas encompass the rest of the nation. Class III areas allow a larger incremental increase of pollutants than Class I or II. No Class III areas have been designated at this time.

Airborne radioactive material releases are regulated under the National Emissions Standards for Hazardous Air Pollutants (NESHAP) and are discussed in Section 3.12.

3.6.1 SMTS

NTS is located within Nevada Intrastate Air Quality Control Region 147 and, in accordance with national and state of Nevada air quality standards, is in attainment for all criteria pollutants. NTS is designated as a Class II air quality region. There are PSD monitoring requirements for NTS. The nearest nonattainment area is Las Vegas, which does not meet the NAAQS for CO and PM_{10}.

NTS has a desert climate characterized by cool winters, hot summers, low rainfall (approximately four inches per year), and generally predictable wind patterns. Predominant winds are northwesterly in winter, southwesterly in summer, and westerly in spring and fall; daily variations are typically southwesterly in early afternoon and northerly from sundown to midday. The topography of NTS is conducive to good air dispersion.

Air Pollution Emission Sources

Air pollution sources found within the NTS area include aggregate production, surface disturbances, fugitive dust from unpaved roads, fuel burning equipment, open burning, and fuel storage facilities (DOE, 1990d). NTS currently has 24 air quality operating permits and 16 permits to construct from the state of Nevada. These combined activities produce all NAAQS criteria pollutants in levels below NAAQS standards. No emission sources are found in the immediate vicinity of the SMTS.

3.6.2 CTF

INEL is located within Eastern Idaho Intrastate Air Quality Control Region 61 and, in accordance with national and state of Idaho air quality standards, is in attainment for all criteria pollutants. INEL is designated as a Class II air quality region; however, a large portion of Craters of the Moon National Monument, which is located 42 miles southwest of the CTF, is designated as a Class I air quality region. The nearest non-attainment area is Pocatello, Idaho, 75 miles south of the CTF. Pocatello exceeds the NAAQS for PM_{10}. There are no PSD monitoring requirements for INEL.

INEL is situated in a semi-arid region with warm summers and cold winters; average annual precipitation is 9 inches. The prevailing wind directions are from the southwest to west-southwest and from the north-northeast to northeast. The topography of INEL is conducive to good air dispersion.

Air Pollution Emission Sources

Air pollution sources found in the INEL area include the calcination of liquid waste, the combustion of coal for steam generation at the Idaho Chemical Processing Plant, and the combustion of fuel oil for heating at various INEL

facilities. Other emissions include fugitive particulate emissions from waste-burial activities and coal piles, other process emissions, vehicular emissions, and temporary emissions from various construction activities. These combined activities produce all NAAQS criteria pollutants, but do not exceed the NAAQS. Air pollution emission permits for two major sources, following PSD regulation requirements (40 CFR 52), have been approved. PSD permits were obtained for a coal-fired, steam-generating plant next to the Idaho Chemical Processing Plant (DOE-24) and for the Fuel Processing Restoration Facility, both of which are located within INEL (DOE, 1991a). INEL has no PSD station.

3.7 BIOLOGICAL RESOURCES

Biological resources include the native and introduced plants and animals in the project area. For discussion purposes, biological resources are divided into vegetation, wildlife, threatened or endangered species, and sensitive habitats.

Sensitive habitats include wetlands, plant communities that are unusual or of limited distribution, and important seasonal use areas for wildlife (e.g., migration routes, breeding areas, or crucial summer/winter habitat).

The regions of influence for biological resources are the project site areas and associated areas potentially affected by construction for needed infrastructure (i.e., utility and road extensions or improvements). For the SMTS, the region of influence is approximately 100 acres; for the CTF site, which contains existing developed areas and infrastructure, the region of influence is 100 acres, including less than 50 acres of vegetation disturbed during previous activities at the site. To provide context, regional aspects of vegetation, wildlife, and threatened and endangered species are also discussed.

3.7.1 SMTS

3.7.1.1 Vegetation. The flora of the SMTS is typical of that of the Mid Valley area. Mid Valley is described as Transitional Desert Association, which extends in a broad east-west corridor between the Mojave and Great Basin deserts at elevations of between 4,000 and 5,000 feet MSL (DOE, 1986). Vegetation within this association consists predominantly of widely spaced clumps of low brush interspersed with sparse growths of grasses and other low plants and scattered Joshua trees and Mojave yucca (Sandia National Laboratories [SNL], 1990b). Vegetative coverage of the soil surface is approximately 20 percent. Blackbrush is the predominant plant species (Table 3.7-1). Brush fires have resulted in modification of the vegetation of the area.

Table 3.7-1. Common Species at NTS

Common Name	Scientific Name
Vegetation	
Blackbrush	*Coleogyne ramosissima*
Joshua tree	*Yucca brevifolia*
Mohave yucca	*Yucca schidigera*
Red bromegrass	*Bromus rubens*
Wildlife	
Le Conte's thrasher	*Toxostoma lecontei*
Black-throated sparrow	*Amphispiza bilineata*
Side-blotched lizard	*Uta stansburania*
Western whiptail	*Cnemidophorus tigris*
Coachwhip	*Masticophis flagellum*
Speckled rattlesnake	*Crotalus mitcheli*
Gopher snake	*Pituophis melanoleucus*
Western shovel-nosed snake	*Chinactis occipitalis*
Desert cottontail rabbit	*Sylvilagus audubonii*
Mule deer	*Odocoileus hemionus*
Kit fox	*Vulpes velox macrotis*
Coyote	*Canis latrans*

3.7.1.2 Wildlife. The southern Great Basin is occupied by a variety of birds, reptiles, and mammals representing faunal elements from both the Mojave and Great Basin Deserts. Wildlife habitat on the SMTS has been modified to a considerable degree by brush fires. Because there is no sport hunting and only a limited amount of pest control, faunal populations are regulated only by the natural controls imposed by the environment and normal predator/prey relationships. Rodents account for almost half of the known species and are, in terms of distribution and relative abundance, the most important group of mammals.

Several species of birds are recorded as either seasonal or permanent residents in the vicinity of the SMTS. Resident species include Le Conte's thrasher and black-throated sparrow. Other sparrows and finches migrate through the southern Great Basin and utilize the area as a winter feeding ground. Several species remain as winter residents due to an abundance of tumbleweed seed in disturbed areas.

Reptiles observed in the region include eight species of lizards, the desert tortoise, and four species of snakes. The side-blotched lizard and western whiptail are the most frequently observed species. Coachwhips, speckled

rattlesnakes, gopher snakes, and western shovel-nosed snakes have been observed infrequently (DOE, 1986).

Transient animals include desert cottontail rabbits, mule deer, kit fox, and coyotes. Other larger mammals, such as bobcats and mountain lions, are observed occasionally throughout this region of NTS.

3.7.1.3 Threatened and Endangered Species. No federally listed threatened or endangered species are known to be present at the SMTS. The desert tortoise *(Gopherus agassizii)*, listed by the federal government as threatened, is found south of SMTS (U.S. Fish and Wildlife Service, 1992b). Potential impacts to the desert tortoise from normal operation of NTS are discussed in a Biological Assessment of NTS (DOE, 1991f) and a resultant no-jeopardy Biological Opinion (U.S. Fish and Wildlife Service, 1992a).

3.7.1.4 Sensitive Habitats. No wetlands are present at the SMTS, and no other sensitive habitats are present on the site. Yucca Flats (Dry) Lake, an ephemeral lake and potential wetland, is located 8 miles east of the SMTS.

3.7.2 CTF

3.7.2.1 Vegetation. The CTF is located within an area of previous disturbance and development that is vegetated by rabbitbrush and other invader species (Table 3.7-2). Other plant species found in the vicinity of CTF include saltbush and Indian ricegrass (DOE, 1991a). Crested wheatgrass has been planted along the roadways. No other species were noted on the site. The area adjacent to the CTF site (where SNTP support facilities would be built) has previously been disturbed, but has re-vegetated. Existing vegetation includes invader species and native plants, such as winterfat, lupine, and other grasses (DOE, 1992g).

3.7.2.2 Wildlife. The CTF site supports limited wildlife habitat because the area has been disturbed by previous construction and operation activities. Thirty-seven species of mammals are known to occur in the vicinity of the CTF site. Of these, 22 are rodents, including 4 species of hares and rabbits, 6 are carnivores (coyotes, long-tailed weasel, and badger are most common), and 9 belong to other groups. Resident populations of mule deer and pronghorn may be found nearby. Pronghorn are found throughout the INEL and are generally considered abundant. Most pronghorn in southeastern Idaho are migratory. During winter, 4,500-6,000 pronghorn, or about 30 percent of Idaho's total population, may be on INEL (DOE, 1988a). Occasional small herds of elk are also found throughout INEL.

A total of 184 bird species have been observed at various times of the year on the INEL (DOE, 1991a). The sage sparrow, horned lark, Brewer's sparrow, black-billed magpie, robin, and sage thrasher are the most common passerine breeding species. The sage grouse is the most common upland

Table 3.7-2. Common Species at INEL

Common Name	Scientific Name
Vegetation	
Saltbush	*Atriplex confertifolia*
Rabbitbrush	*Chrysothamnus viscidiflorus*
Indian ricegrass	*Oryzopsis hymenoides*
Crested wheatgrass	*Agropyron cristatum*
Wildlife	
Sage sparrow	*Amphispiza belli*
Horned lark	*Eremophila alpestris*
Brewer's sparrow	*Epizella passerina*
Black-billed magpie	*Pica pica*
American robin	*Turdus migratorius*
Sage thrasher	*Oreoscoptes montanus*
Sage grouse	*Centrocercus urophasianus*
American kestrel	*Falco sparverius*
Long-eared owl	*Asio otus*
American rough-legged hawk	*Buteo lagopus*
Prairie falcon	*Falco mexicanus*
Golden eagle	*Aquila chrysaetos*
Short-horned lizard	*Phyrnosoma douglassi*
Sagebrush lizard	*Sceloporus graciosus*
Gopher snake	*Pituophis melanoleucus*
Western rattlesnake	*Crotalus viridis*

game bird and breeds throughout the site. The most common raptor species found on the INEL during the breeding season include the American kestrel and the long-eared owl. The most abundant raptors observed during the nonbreeding season include the American rough-legged hawk, American kestrel, prairie falcon, and golden eagle.

Nine species of reptiles have been recorded on INEL. Of these, the short-horned lizard, sagebrush lizard, gopher snake, and western rattlesnake are observed most frequently.

3.7.2.3 Threatened and Endangered Species. No federally listed threatened or endangered plants are found at or adjacent to the CTF. The bald eagle *(Haliaeetus leucocephalus)* is the only animal observed that is listed by the federal government as endangered (U.S. Fish and Wildlife Service, 1992b). The bald eagle usually winters on or near the northern portion of INEL, and a

roosting site for several eagles is located at the Little Lost River, approximately 12 miles southwest. The Swainson's hawk and the ferruginous hawk are two additional raptors found at INEL which are candidate species for listing as endangered or threatened.

Both Swainson's hawks *(Buteo swainsoni)* and ferruginous hawks *(Buteo regalis)* are uncommon migrants, uncommon summer breeders, and rare winter visitors to the vicinity.

3.7.2.4 Sensitive Habitats. No sensitive habitats are present at or adjacent to the CTF due to the developed nature of the facility and previous disturbance of vegetation. Temporarily inundated areas appear periodically on INEL during periods of high water flow in the Big Lost River and provide habitat for migratory waterfowl, shore birds and other wildlife species. Riparian wetland vegetation (primarily cottonwoods and willows) occurs along the Big Lost River and along Birch Creek, approximately 1 mile from the CTF. Some of the temporarily inundated areas and the riparian wetland vegetation areas may classify as wetlands; but all are upstream from the CTF, and none are adjacent to the CTF. Other sensitive habitats, such as anadromous fisheries, are very distant from the CTF and would not be affected.

3.8 CULTURAL RESOURCES

Cultural resources consist of prehistoric and historic districts, sites, structures, artifacts, and any other physical evidence of human activity considered important to a culture or community for scientific, traditional, religious, or other reasons. Cultural resources can be divided into three major categories: archaeological resources (prehistoric or historic), historic resources and structures, and Native American (traditional) resources. For the purposes of this EIS, cultural resources are also defined to include a fourth category, paleontological resources.

Numerous laws and regulations require federal agencies to consider the effects of a proposed project on cultural resources. These laws and regulations stipulate a process for compliance, define the responsibilities of the federal agency proposing the action, and prescribe the relationship among other involved agencies (e.g., the State Office of Historic Preservation and the Advisory Council on Historic Preservation). Compliance with the requirements of these laws and regulations involves four basic steps:

(1) Identification of significant cultural resources that could be affected by a Proposed Action or its alternatives;

(2) Assessment of the impacts or effects of these actions;

(3) Evaluation of significance of potential historic properties within the area of potential effect (APE); and

(4) Development and implementation of measures to eliminate or reduce adverse impacts.

In addition to NEPA, the primary laws that govern the treatment of cultural resources during environmental analyses are the National Historic Preservation Act (especially Sections 106 and 110), the Archaeological Resources Protection Act, the American Indian Religious Freedom Act, and the Native American Graves Protection and Repatriation Act. Public Law 74-292 (the National Natural Landmarks Program) (implemented by 36 CFR 62) governs paleontological resources.

Only those cultural resources determined to be potentially significant under the given legislation are subject to protection from adverse impacts resulting from a Proposed Action. To be considered significant, cultural resources (exclusive of paleontological resources which have other criteria) must meet one or more of the criteria established for inclusion on the National Register of Historic Places (National Register). According to these criteria (as defined in 36 CFR 60.4), the quality of significance is present in districts, sites, buildings, structures, and objects that demonstrate the following:

- Are associated with events that have made a significant contribution to the broad patterns of history
- Are associated with the lives of persons significant in the past
- Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; possess high artistic value; or represent a significant and distinguishable entity whose components may lack individual distinction
- Have yielded, or may be likely to yield, information important in prehistory or history.

Resources must also possess integrity of location, design, setting, materials, feeling, and association. Significant cultural resources, either prehistoric or historic, are referred to as "historic properties."

While paleontological resources do not have the degree of legal protection afforded cultural resources, they are considered and protected under several laws, including the Antiquities Act. Idaho State Code 67:4112-4119 protects "archaeological and vertebrate paleontological sites and resources on public lands in the state" and NTS Standard Operating Procedure 5407 "assures the protection and preservation of any antiquities, historic sites, or threatened and endangered plant species on the NTS" (DOE, 1990g). The

criteria by which paleontological resources are considered for National Natural Landmark designation are defined in 36 CFR 62.5(b).

Once it has been determined that a federal agency's Proposed Action will constitute an undertaking (any project, activity, or program that can result in changes in the character or use of historic properties), the Area of Potential Effect (APE) must be defined and the historic properties within it identified. The APE of cultural resources in this analysis (referred to as the region of influence), is different for each location described below.

3.8.1 SMTS

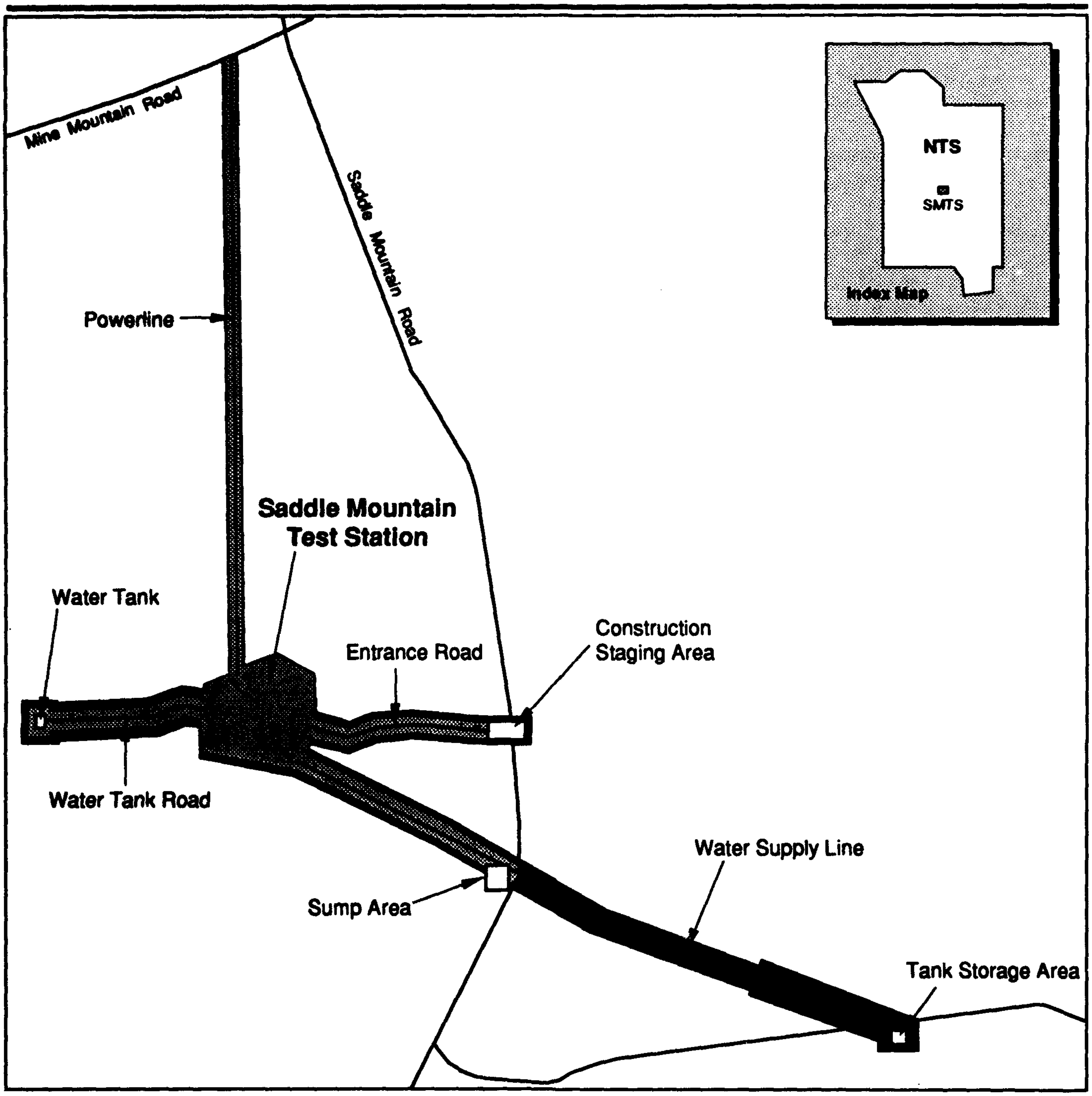
The region of influence for the SMTS at NTS is the area south of Mine Mountain Road and west of Saddle Mountain Road in a remote, isolated, and undisturbed area known as Mid Valley (see Figure 2.3-2). Mid Valley is bordered by Shoshone Mountain to the west and northwest, Mine Mountain to the east, and Lookout Peak to the south. Human occupation of the area dates from as early as 12,000 years before present, as evidenced by lithic scatters, diagnostic projectile points, pottery shards, and other artifacts that have been identified from numerous recorded and unrecorded sites and rock shelters.

Archaeological Resources

In September 1988, the Desert Research Institute (DRI) intensively surveyed a portion of the region of influence for SNTP program activities (Figure 3.8-1). Three roads, the facility area, and the transmission route were inspected by walking 30-meter (100-foot) transects and five sites were recorded. All sites were small and were collected in accordance with Bureau of Land Management policy; none of the sites were considered eligible for nomination to the National Register. The five sites are identified as follows:

Site 26Ny5776	Pink, non-welded tuff unifacial chopper
Site 26Ny5777	Obsidian core reduction flake
Site 26Ny5778	Brown chert Rosegate point and an obsidian core reduction flake
Site 26Ny5779	Obsidian biface thinning flake
Site 26Ny5780	Six obsidian core reduction flakes, one with a utilized edge.

In May 1992, the remaining portions of the proposed PBR validation test area (including the water supply line) were surveyed by DRI using the same survey techniques used in the previous surveys. Two sites were recorded, both of which were isolated surface finds and neither of which is considered eligible for nomination to the National Register. The two sites were left undisturbed and are described as follows:



EXPLANATION

Cultural Resource Surveys

1988

1992

0 500 1000 2000 Feet

Nevada Test Site

SMTS Site Cultural Resource Surveys

Figure 3.8-1

Site 26Ny8002 Isolated obsidian biface
Site 26Ny8003 Isolated obsidian core reduction flake.

Historic Resources and Structures

Although historic resources are known to exist in the Mid Valley area, no such resources have been identified within the region of influence for SNTP program activities. The closest identified historic site is a campsite (26Ny3913) approximately one mile southwest of the SMTS.

Native American Resources

The Nevada Test Site American Indian Religious Freedom Act Compliance Program has identified 17 tribal groups with historic or cultural ties to NTS, among them the Owens Valley Paiutes, who consider NTS as part of their homeland. Claims by the Western Shoshone that the Treaty of Ruby Valley established Shoshone ownership of NTS land have been invalidated and superseded by both Supreme Court and Ninth Circuit decisions.

Cultural resources investigations have not identified any Native American sacred or ceremonial sites within or near the SMTS region of influence.

Paleontological Resources

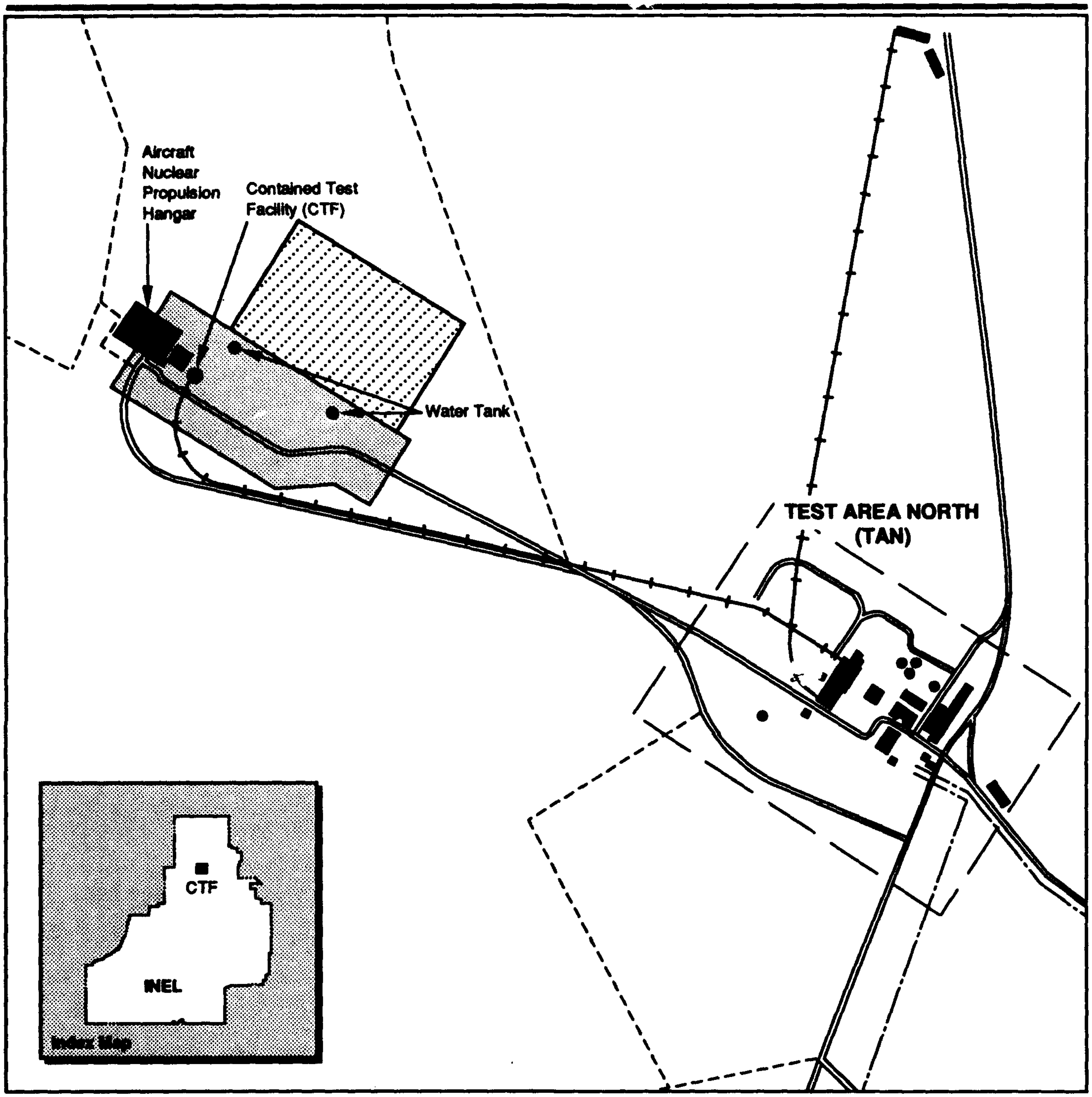
No paleontological resources have been identified within the SMTS region of influence.

3.8.2 CTF

The region of influence for the CTF is the immediate area around the proposed project site (Figure 3.8-2). Existing facilities, paved roads, and infrastructure already exist and the entire facility area has been previously disturbed through grading and construction, including raising the surface of the site by about 15 feet with fill pads. Archaeological, paleontological, and historical record searches at EG&G Idaho, Inc.'s Cultural Resources Management office in April 1992 verified known cultural resources present at the CTF site, and an inspection of the facilities and grounds was made at that time to locate the archaeological sites and appraise the integrity of standing structures (EG&G Idaho, Inc., 1992).

Archaeological Resources

Several areas associated with the TAN facility, including the CTF, were examined between 1982 and 1985 as a part of a program designed to identify cultural resources in danger of being disturbed through increased installation activities on the INEL (Idaho State University, 1986) (Figure 3.8-2). An additional survey was performed in July 1992 as a part



EXPLANATION

- - - - - -	Dirt Roads		1985 Survey
——·——	Transmission Lines		1992 Survey
═══	Improved Road		
—+—+—+—	Railroad Track		

0 350 700 1400 Feet

Idaho National Engineering Laboratory

CTF Site Cultural Resource Surveys

Figure 3.8-2

of activities to identify cultural resources within the SNTP region of influence. The July 1985 survey of a 100-meter-wide zone (328 feet) surrounding the CTF, identified one sparse lithic scatter (10-BT-1234) and one isolated activity area (10-BT-1235). The July 1992 survey of the area where gas and cryogenic liquids would be stored for SNTP activities identified one additional area (EGG-92-34). All of these sites are located within a disturbed surface context where sheet erosion occurs regularly and none are likely to yield any additional information; none of the three are considered eligible for nomination to the National Register (Appendix G).

Historic Resources and Structures

INEL has a long tradition of pioneering advances in science and contai largest concentration of nuclear reactors in the world; over the years reactors, most of them first-of-a-kind facilities, have been built at INEL (INEL, 1986). Experimental Breeder Reactor-I, the first reactor built at INEL and the first to produce commercial electricity by nuclear fission, is a National Historic Landmark.

Native American Resources

The Northern Shoshone and Bannock tribes of Idaho consider the area of INEL a part of their homeland. Cultural resource investigations have not identified any Native American sacred or ceremonial sites within the CTF region of influence.

Paleontological Resources

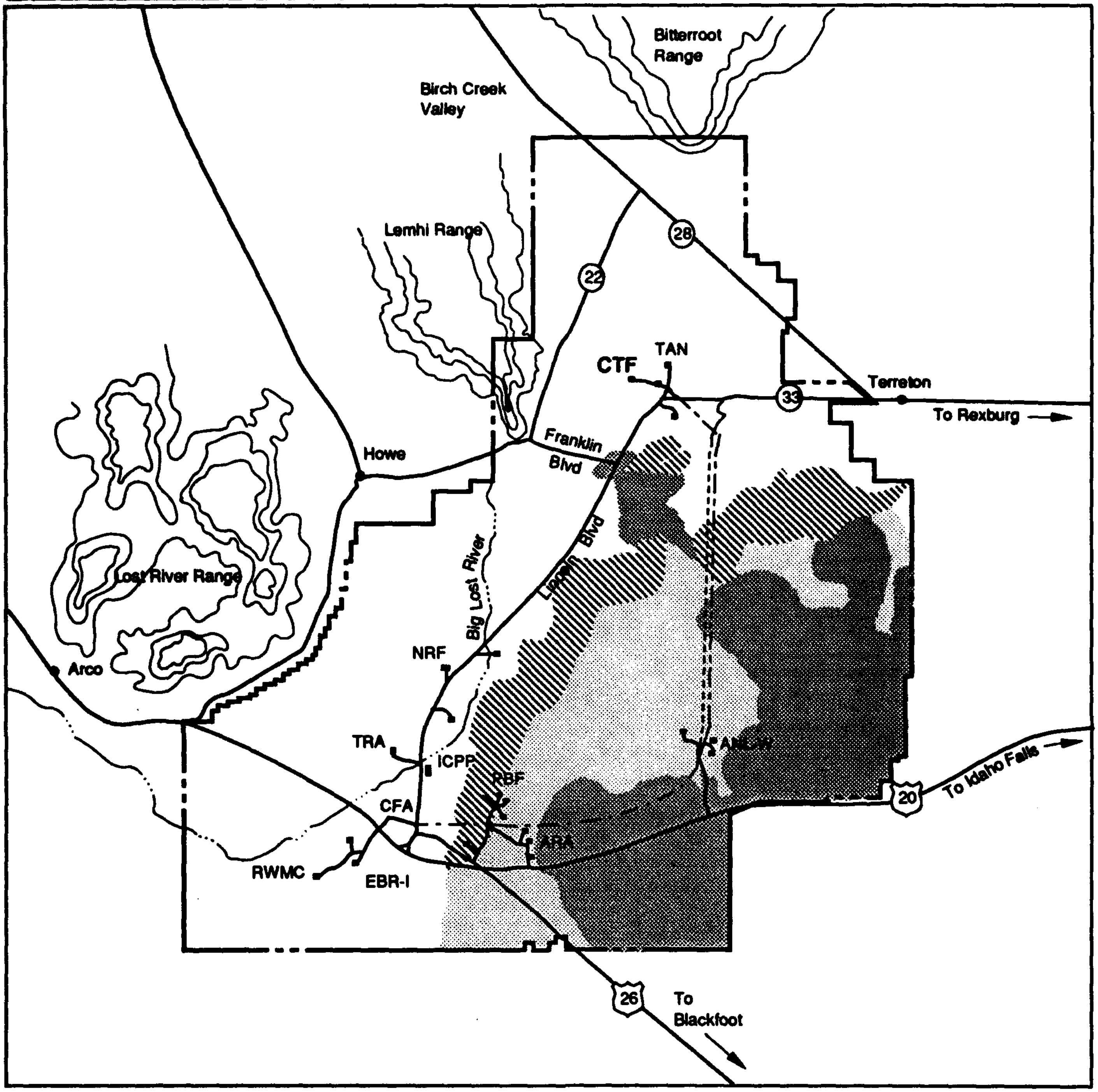
While fossil camel remains have been identified in the vicinity of the TAN facility, no paleontological resources have been recorded or identified within the CTF region of influence. Other paleontological resources have been found throughout INEL (Figure 3.8-3).

3.9 GEOLOGY AND SOILS

This section outlines the nature of physiography (landforms, including floodplains), geologic units and structures, seismic and volcanic activity, and surficial soils of the sites and their surroundings. The region of influence for soils is the immediate vicinity of the site alternatives; the region of influence for the other aspects is the regional setting as well as the immediate alternative sites.

3.9.1 SMTS

3.9.1.1 ***Regional Geologic Setting.*** Most of Nevada, including NTS, is in the Great Basin region of the Basin and Range Physiographic Province. Block faulting on numerous dip-slip and oblique-slip faults throughout the



EXPLANATION

High Density

Moderate Density

Low Density

0 2 4 8 Miles

ANL-W - Argonne National Laboratory West
ARA - Auxiliary Reactor Area
CFA - Central Facility Area
CTF - Contained Test Facility
EBR-I - Experimental Breeder Reactor-I
ICPP - Idaho Chemical Processing Plant
NRF - Naval Reactors Facility
PBF - Power Burst Facility
RWMC - Radioactive Waste Management Complex
TAN - Test Area North
TRA - Test Reactor Area

Idaho National Engineering Laboratory

Paleontological Sensitivity

Figure 3.8-3

province has produced a topography that is dominated by elongated, steep-sided, generally north- to northeast-trending mountain ranges and intervening valley basins. Throughout much of the province, valley subsidence during faulting and crustal extensions is occurring faster than mountain erosion and valley infilling, creating closed basins between the mountains with internal drainage and intermittent playa lakes.

The mountain ranges in the Great Basin are composed primarily of complexly faulted and folded sequences of Paleozoic (approximately 570 to 225 million years ago) sedimentary rocks overlain by Tertiary (approximately 65 to 3 million years ago) rocks, including volcanic ash (tuffs and tuffaceous rocks) and volcanic flows (rhyolite). These mountains were uplifted by roughly parallel block faults, with intervening basins being filled with Quaternary (approximately 3 million years ago to present) unconsolidated sediments (alluvium) that were eroded from the mountains (Stewart, 1980).

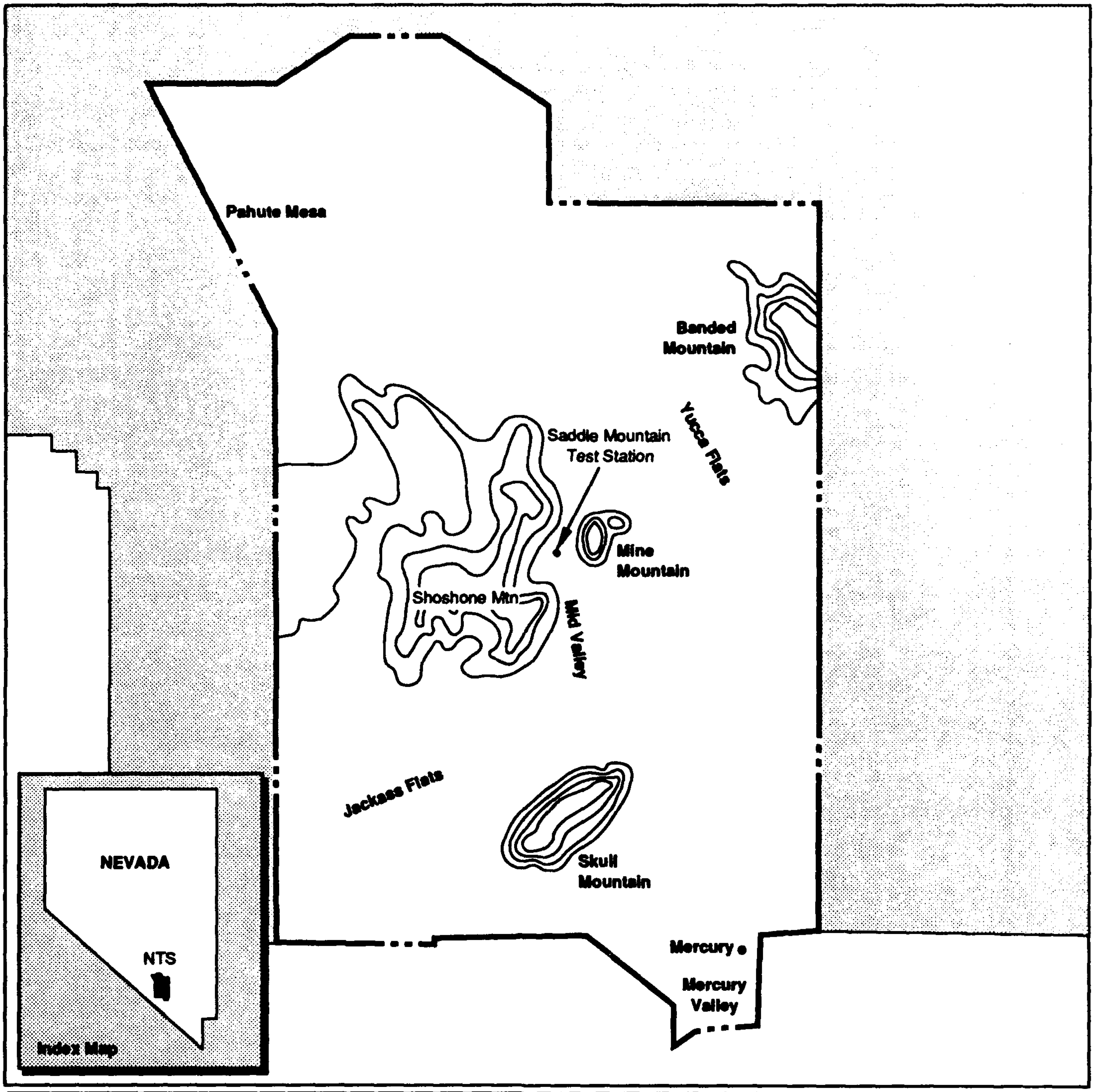
Intermountain basins of the region contain alluvial and debris flow deposits derived from mountain erosion. Bouldery deposits along mountain flanks grade to sandy and silty alluvial plains and clayey playa deposits in the valley bottoms geology of the site vicinity. No mineral ores or construction materials (i.e., aggregate) have been identified at the SMTS.

The SMTS is located on the eastern footslope of Shoshone Mountain, in Mid Valley (Figure 3.9-1). The elevation of the SMTS is approximately 4,800 feet above mean sea level (MSL). Elevations at NTS range from 3,000 to 4,000 feet MSL in the basins to over 7,000 feet MSL in the mountains.

The SMTS is located on an older, dissected, inactive alluvial fan (as defined by Christenson and Purcell, 1985) in the western part of Mid Valley. Erosion of these fan deposits by modern valley drainage has left the SMTS area as a sloping interchannel plain as much as 60 to 80 feet above the alluvium of the present-day washes. Slopes of the site range from about 5 percent on the interchannel plains to 25 percent in the washes and gullies.

Shoshone Mountain to the west of the SMTS consists of west-dipping limestone and dolomite basement rocks with overlying, nearly horizontal sheets of volcanic rocks (rhyolite, dacite, and welded and unwelded tuffs). The range, like the others nearby, is cut by a number of steeply dipping north- and northeast-trending faults of largely unknown activity. Other faults in bedrock are presumed to be buried beneath the young valley fill deposits of Mid Valley (Frizzell and Shulters, 1990).

Typical of the geologic structure of much of the Great Basin, bedrock is cut by several steeply dipping normal faults along the western boundary of Mid Valley. These faults are concealed beneath alluvial deposits at the proposed test facility site; their locations are approximated by extension from



EXPLANATION

Nevada Test Site

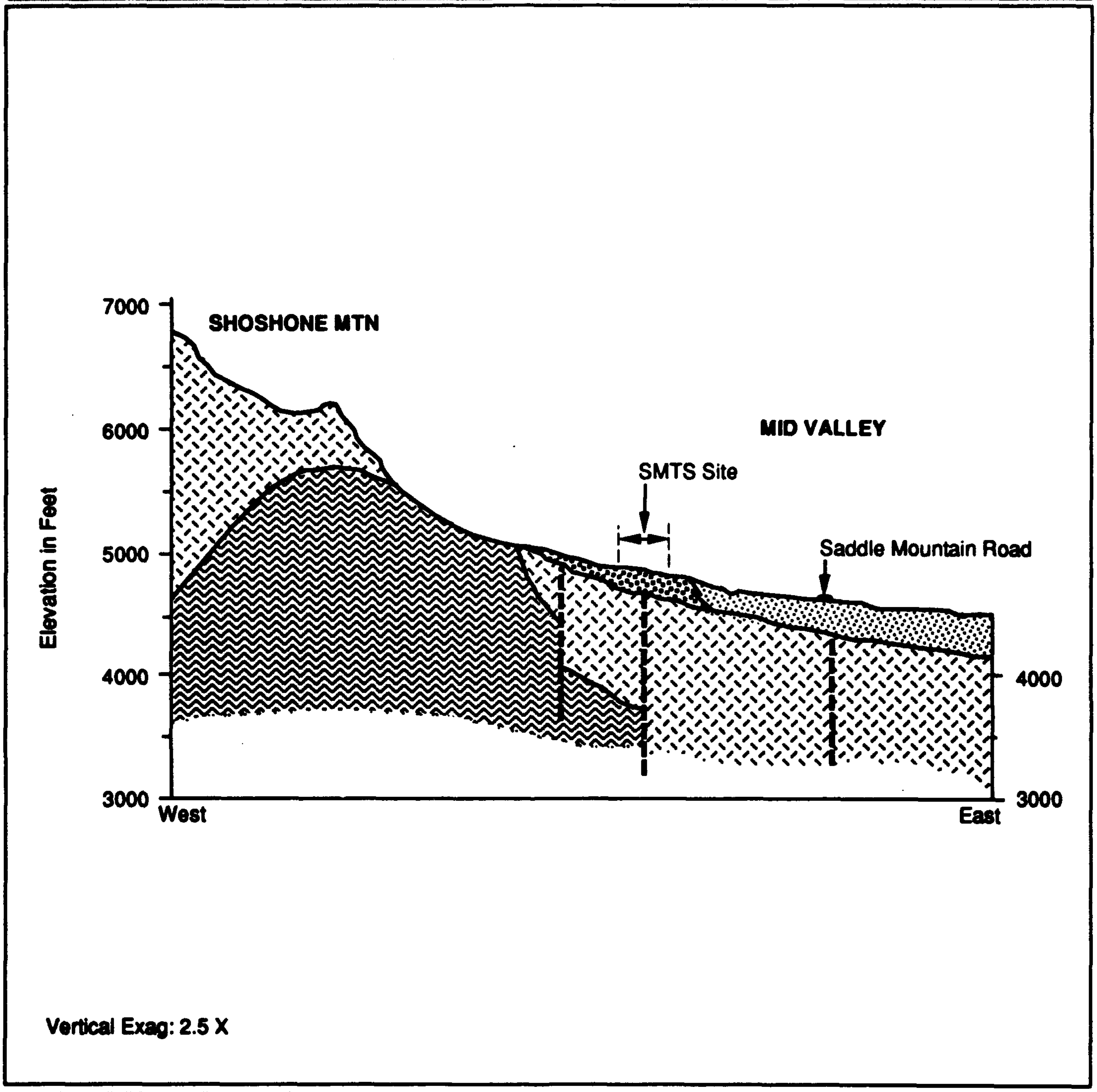
Nellis Air Force Range

0 2 4 8 Miles

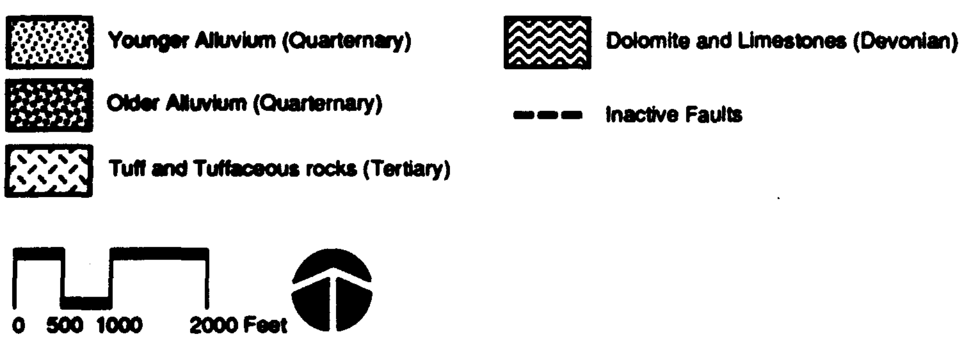
Nevada Test Site

Physiographic and Topographic Features

Figure 3.9-1



EXPLANATION



Saddle Mountain Test Station

Schematic Geologic Cross Section

Figure 3.9-2

observed faults to the north and the south (Figure 3.9-2). Because the overlying sediments in the SMTS area do not show displacement from the inferred faults shown on Figure 3.9-2, these faults are considered to be inactive. However, 32 other faults in the general area do show Quaternary movement; dates of the latest movement on these faults have ranged from 40,000 to 2 million years ago (DOE, 1986).

3.9.1.2 **Seismic Activity**. The seismic character of NTS and its surrounding region has had much research because of its use as a nuclear explosion test site and its potential for use as a disposal site for radioactive waste. The Southern Nevada Seismograph Network was installed in 1978 to monitor the NTS area. Together with older instrument data and historic information, the Network gives an exceptionally detailed account of regional seismicity (Vortman, 1991). When the effects of weapons tests, mine blasts, and other induced shocks are edited from the catalogue, the NTS region appears to be similar to the rest of the southern Basin and Range province, with diffuse, low magnitude earthquake activity. The crust of the region is believed to be now extending in a west-to-northwest direction at about 3 millimeters per year by the interplay of many small fault movements (National Research Council, 1992).

Available data suggest that earthquakes with magnitudes of less than 4.5 on the Richter scale occur with a frequency of less than one per year within 24 miles of the proposed site. The nearest recorded larger earthquake occurred on June 29, 1992, had a magnitude of 5.6, and was centered six miles beneath Little Skull Mountain, approximately 16 miles southwest of the proposed site. Subsequent investigations of the aftershocks have identified a hidden fault that ruptured approximately 7.8 miles beneath the earth's surface. The Yucca Mountain Project Field Office in Area 25, approximately 12 miles from the epicenter, experienced some structural damage, including about one-third of the windows being broken.

Data from two recent large underground tests show maximum ground accelerations of 0.003 gravities and 0.1 gravities in the vicinity of the site (SNL, 1991a, 1991b). Peak ground accelerations from tectonic earthquakes in southern Nevada have not exceeded 0.5 gravities. No information is available on the latest date of movement on the concealed faults that may underlie the SMTS and no evidence of any ground-shock-induced displacements has been reported in the Mid Valley area.

Underground nuclear tests (UGTs) at NTS have caused small displacements along preexisting faults in the NTS region. The Yucca fault in Yucca Flat, about 10 miles northeast of the SMTS, has explosion-induced displacement of up to 1.5 feet by UGT along most of its 15-mile length. Preexisting faults on Pahute Mesa characteristically exhibit displacement from UGT, resulting in vertical offsets of about 1 foot or less for distances of as much as 3 miles along the fault. It is not considered possible for UGTs to trigger earthquakes

on pre-existing faults at distances greater than a few miles (Vortman, 1991). No shock-induced displacements have been reported for the Mid Valley area.

Mid Valley lies in an area of relatively low historical seismicity and is assigned to seismic risk zone 2 (moderate damage) of the Uniform Building Code (UBC). However, due to the activity induced by the underground testing, all structures at the NTS conform to the requirements of UBC Zone 4 (greatest seismic risk zone).

3.9.1.3 Volcanic Activity. The most recent explosive volcanic activity in the region occurred more than 7 million years ago at Black Mountain, about 28 miles northwest of the SMTS. Regional extension of the southern Basin and Range province during the past 6 million years has been locally accompanied by eruption of cinder cones and flows of basalt. Cinder cones of Crater Flat, about 21 miles southwest, are nearest to the site. Their most recent volcanic activity is estimated to have been about 20,000 years ago (Wells et al., 1990).

3.9.1.4 Soils. The U.S. Soil Conservation Service has not mapped NTS for detailed soil units and properties; however, other agencies have studied portions of NTS (e.g., Leavitt, 1970; Leavitt and Mason, 1971); detailed mapping of the SMTS has not been performed.

The proposed SMTS site is underlain by older alluvial fan deposits of Quaternary age (see Figure 3.9-2); these deposits consist of unconsolidated and weakly consolidated mixtures of cobbles and pebbles of welded tuff and limestone in a matrix of silt and sand. Occasional large boulders are found at or near the surface. The percolation rate at the site averages 37 minutes per inch. At various depths the materials are cemented by calcium carbonate into hard concrete-like layers of caliche. These older alluvial materials are estimated to be less than 200 feet thick over bedrock at the proposed site.

Alluvial soils are typically loams, or loams with high content of sand, gravel, or cobbles. Older fans commonly have stabilized topsoil surfaces that minimize erosion. Erosion by wind or occasional floods can be slight or moderate; wind erosion of fine-grained particles is the most-likely event during ground-disturbing activities. These types of soils are generally satisfactory for construction of facilities.

3.9.2 CTF

3.9.2.1 Regional Geologic Setting. INEL is located on the Eastern Snake River Plain, a physiographic depression extending from the Idaho-Oregon border on the west to the Island Park-Yellowstone Volcanic Plateau on the east. Volcanic rocks of the Eastern Snake River plain include caldera

rhyolites overlain by basaltic lava flows and pyroclastic rocks (rocks formed from rock fragments ejected from a volcano during an eruption). These volcanics often occur interbedded with alluvial, lake bed (lacustrine), and wind-blown (eolian) sediments. The basalt deposits and interbedded sediments thicken from northeast to southwest along the axis of the Eastern Snake River Plain. Figure 3.9-3 shows a geologic cross-section of the area around the CTF. Basin and Range structural features occur adjacent to the Snake River Plain.

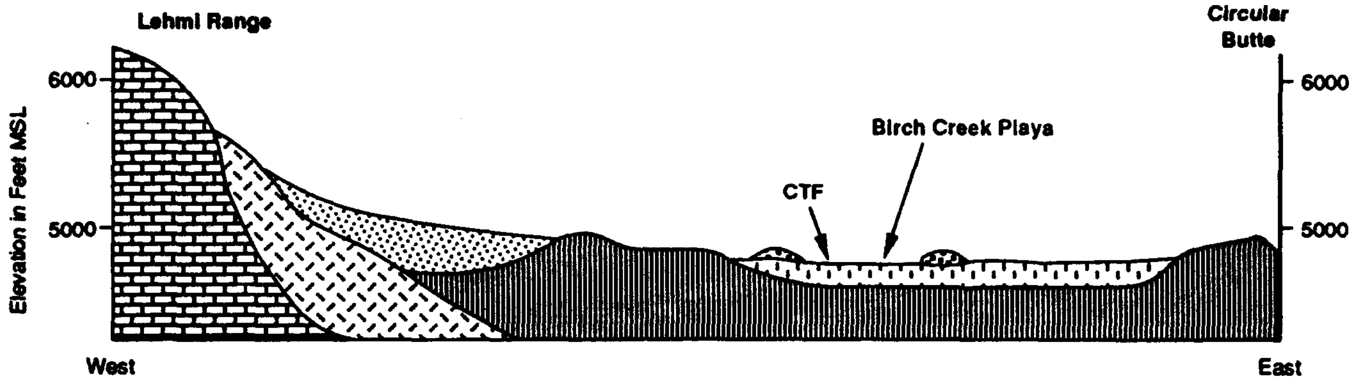
The surface area of INEL is relatively flat, with predominant relief manifested either as volcanic buttes jutting up out of the desert floor or as unevenly surfaced basalt flows and/or flow vents and fissures. Elevations on INEL range from 5,200 feet MSL in the northeast to 4,750 feet MSL in the southwest, with the average being 5,000 feet MSL.

Floodplains

Executive Order 11988 (3 CFR, 1979 Compilation; p. 412) requires that all agencies must determine whether proposed facilities/projects are located in floodplains (areas subjected to one percent or greater chance of flooding in a given year; also known as the 100-year floodplain). If so, the agency must consider alternative sites if feasible. If the project/facility must be located in a floodplain, then this consideration must be included in water and land use plans, the facilities need to be designed to include measures such as elevating structures, and facilities must be constructed in accordance with the intent of National Flood Insurance Program standards.

The CTF is located on a generally flat area, on the western margin of the Birch Creek playa, a very smooth-surfaced ephemeral lake bed with an elevation at its lowest point of about 4,775 feet MSL. Birch Creek (an intermittent stream in the playa area), the Big Lost River (dry in the playa area), and other smaller waterways from the Lemhi Range terminate in the Birch Creek Playa. The original elevation of the CTF area was approximately 4,778 feet MSL; the site elevation was raised during original construction to about 4,790 feet using fill pads.

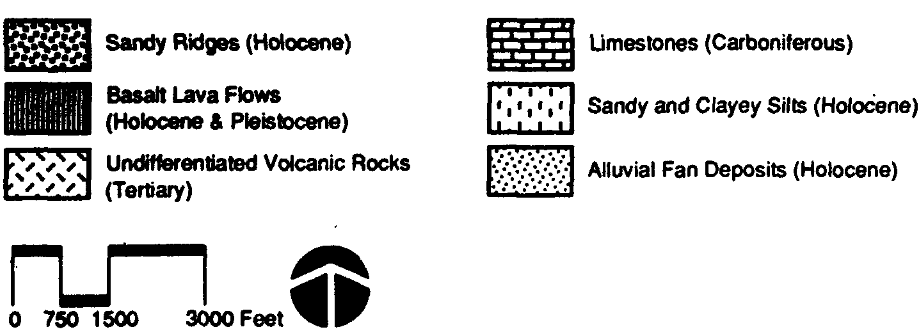
Definitive maps of 100-year floodplains for this area have not yet been developed by Federal Emergency Management Agency or other agencies. Based on the natural configuration of terrain, location of waterways, and historic flooding of the playa, much of the area surrounding the CTF fill pads is a likely floodplain. However, engineering controls/water management practices in the area reduce the likely frequency of floods (and therefore, the delineation of the 100-year floodplain). These controls/practices include the Mackay Dam (approximately 82 miles upstream of the CTF on the Big Lost River), which stores runoff for irrigation; the INEL Diversion, a dam, channel, and spreading areas (Figure 3.11-1) that divert runoff from the Big Lost River at the southern end of INEL; and canals and other conveyances that



Note: Rock unit thicknesses exaggerated for clarity.

Sources: U.S. Geological Survey, n.d.
Hackett and Smith, 1992.

EXPLANATION



Schematic Geologic Cross Section through Contained Test Facility (CTF)

Figure 3.9-3

divert water for agricultural uses. As a result of these features, comparatively little of the water falling in the basin would reach Birch Creek Playa under normal conditions.

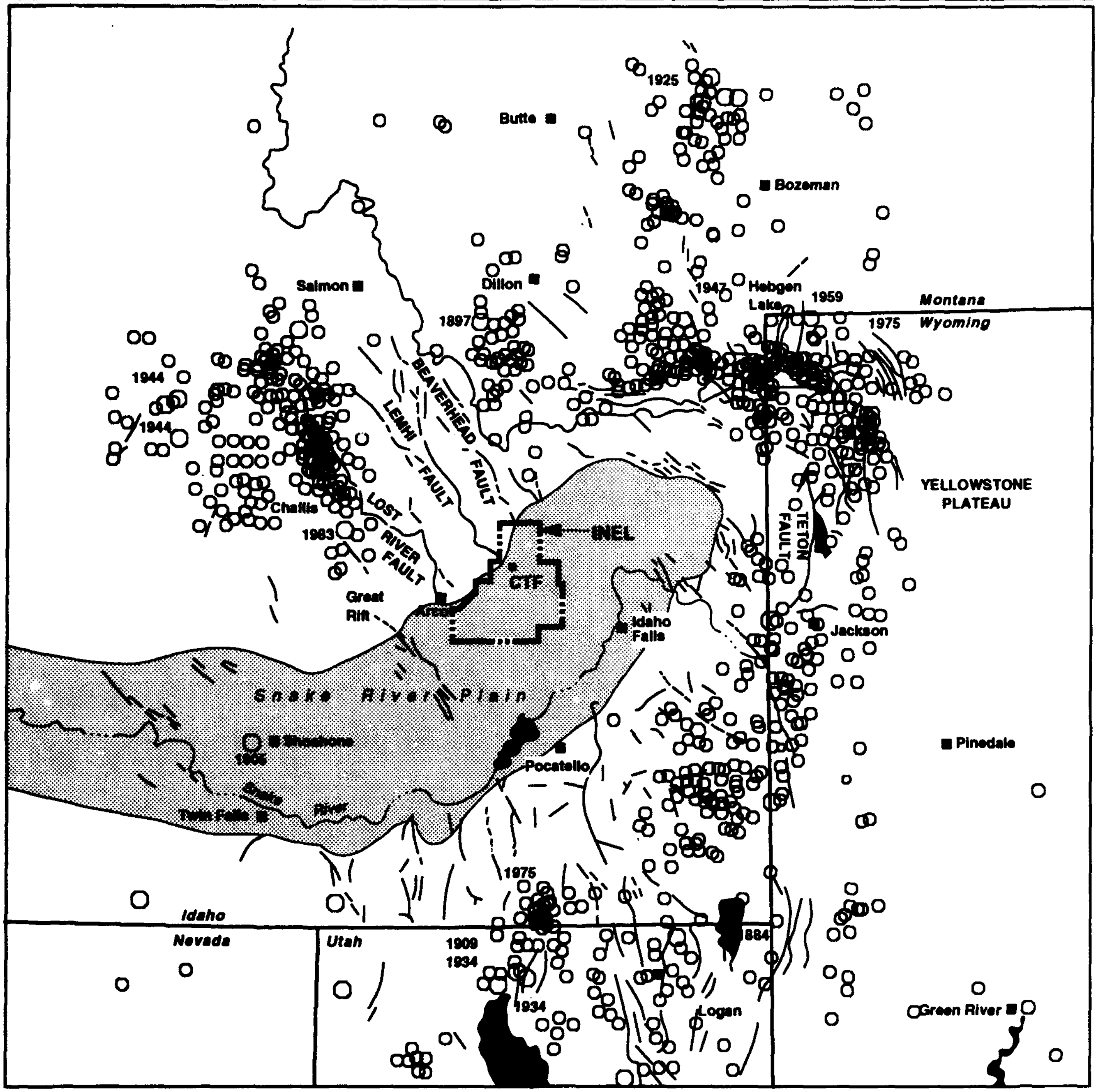
The most specific data available for flooding potential is a modeling analysis of several scenarios for failure of the Mackay Dam (EG&G Idaho, Inc., 1986). The analysis concluded that, during a 100-year flooding event, with a triangular-shaped breach in the dam (caused by underseepage of water at the base of the dam), the CTF area would experience flooding with peak water surface elevation of 4,782 feet MSL. For a peak flooding event (a combination of large storms/snowmelt causing overtopping of the dam, and resultant failure of the dam), the CTF area would experience peak water surface elevation of 4,784 feet MSL. Statistical accuracy and precision calculations on these model outputs were not made, but empirical data from a similar situation using the same model indicate that the model calculated elevations to within an average of 1.5 feet (EG&G Idaho, Inc., 1986).

These data alone do not identify the likely elevation of a 100-year floodplain for Birch Creek Playa, because the study adds a large source of water from behind the dam into the assumed conditions (thereby raising the flood level), but it also does not consider waters from other tributaries (e.g., Birch Creek) in the flood level calculations.

3.9.2.2 Seismic Activity. The potential for seismic activity (and large earthquakes in particular) at INEL and in the Eastern Snake River Plain has been studied in support of numerous programs; some of these studies were not completed, or are still in progress.

The Intermountain Seismic Belt and the Idaho Seismic Zone are the two major areas of seismic activity near the Eastern Snake River Plain. Although large-magnitude earthquakes have not historically originated beneath INEL, large earthquakes have occurred in the adjacent seismic belts (DOE, 1984a; 1984c). The largest recorded earthquake was the magnitude 7.3 Borah Peak earthquake of October 28, 1983, located approximately 55 miles west-northwest of the CTF. Although the earthquake was felt throughout the region, no structural or safety-related damage occurred at INEL. The Borah Peak earthquake, and similar large earthquakes (magnitude greater than 4.0), are associated with the Basin and Range normal faults lying northwest and southwest of the Eastern Snake River Plain (Figure 3.9-4).

The principal Basin and Range faults closest to the site include the Lost River, Lehmi, and Beaverhead Range Front fault systems (Figure 3.9-5), all located northwest of INEL. The Arco fault is the southern segment of the Lost River Range Front fault system. The Arco fault extends southeasterly toward the Eastern Snake River Plain, where vertical displacements die out. Near the southern end of the Arco fault, within the Eastern Snake River Plain, the Arco rift zone contains small normal faults and fissure sets. These



EXPLANATION

Fault

City

INEL Boundary

Richter Magnitude

2
3
4
5
6
7

0 12 24 48 Miles

Source: Woodward-Clyde Consultants, 1992
Jackson et al., in press.

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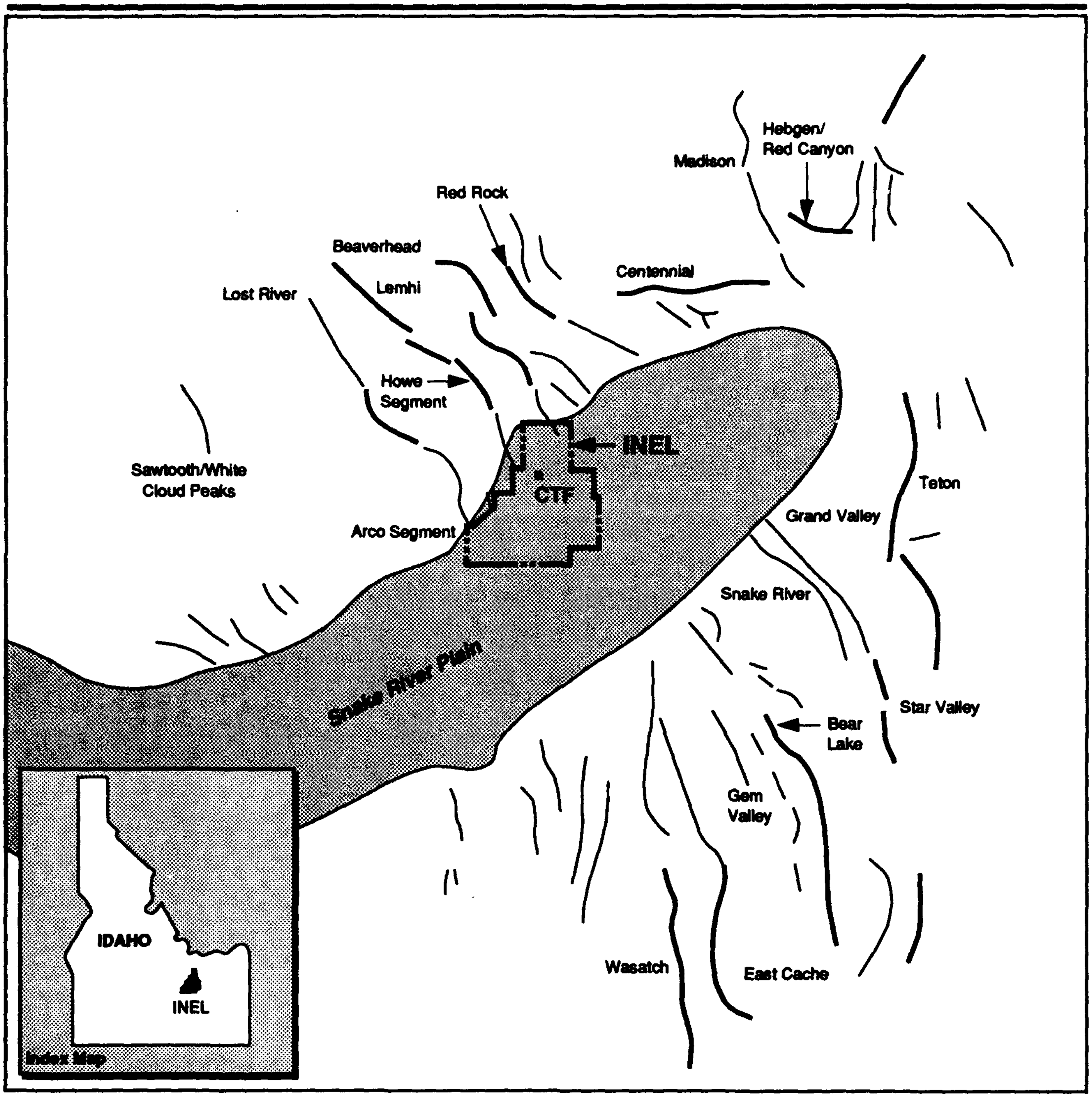
Regional Seismicity Map

Figure 3.9-4



EXPLANATION

Quaternary Normal Faults

Holocene Movement

INEL Boundary

Approximate Boundary of Eastern Snake River Plain

0 10 20 40 Miles

Idaho National Engineering Laboratory

Regional Quaternary Fault Locations

Figure 3.9-5

small displacements appear to be caused by basaltic dike injection (i.e., as part of the igneous activities that created the Eastern Snake River Plain) (Smith et al., 1989; Hackett and Smith, 1992). The last earthquake to rupture the ground surface along the Arco fault occurred between 100,000 and 15,000 years ago, whereas the central segment of the Lost River Range Front fault ruptured during the 1983 Borah Peak earthquake (Crone et al., 1987). Lemhi and Beaverhead Range Front faults extend to the northwest margin of the Eastern Snake River Plain, with displacements decreasing southward to zero.

In contrast to the Basin and Range faulting and seismicity, the Eastern Snake River Plain is characterized by relatively infrequent, small (less than magnitude 2 on the Richter scale) earthquakes (Figures 3.9-4 and 3.9-5). The essentially aseismic nature of the plain is well documented (Smith and Sbar, 1974; Smith, 1978; Smith and Arabasz, 1991; Parsons and Thompson, 1991).

A total of 19 small-magnitude earthquakes (i.e., magnitude less than or equal to 1.5 on the Richter scale, are not felt, and do not cause damage) have been measured within or near the boundary of the Eastern Snake River Plain (Jackson et al., in press). Because of the presence of extensive seismic monitoring capability on INEL, most of the available measurements (13 of the 19 earthquakes) are from events within or near INEL. The remainder of the Eastern Snake River Plain is expected to have a similar rate of small events as the INEL portion of the plain, but small earthquakes outside INEL are not identified as often because there are fewer monitoring stations.

The Eastern Snake River Plain is devoid of larger earthquakes (Figure 3.9-4) with the exception of the 1905 earthquake located at Shoshone, Idaho. This earthquake occurred before monitoring instruments were established in eastern Idaho; the location of the epicenter of the 1905 earthquake has a locational error of 0.5 degrees latitude and longitude (i.e., the actual location of the earthquake could be up to 82 kilometers east or west of the identified site, and up to 107 kilometers north or south of the site). The actual epicenter of the 1905 earthquake was likely outside of the Snake River Plain, possibly near the Idaho-Utah border (Oaks, 1992).

High heat flow and the intrusion of basaltic dikes has been postulated to explain the low seismicity of the plain (Parsons and Thompson, 1991), as stress due to regional extension is accommodated or balanced by the pressures of the intrusion of dikes. The dikes have been intruded along northwest-trending rift zones, oriented perpendicular to the elongation direction of the plain. In some cases, the rifts are roughly parallel with the trends of the Basin and Range fault systems lying to the northwest and southeast. Differences in senses of displacement, style of faulting, and the presence or lack of associated basaltic dike intrusion suggest that the

parallelism of the rifts and range front faults is coincidental, and not representative of through-going tectonic features.

Based on the tectonic setting of the INEL site and surrounding areas, the most significant seismic hazards are related to potential earthquakes along the range front fault systems lying northwest of the site. The lack of fault scarps and general absence of seismicity within the Eastern Snake River Plain suggest a relatively small potential for generating significant earthquakes at or adjacent to the CTF. The CTF is in seismic zone 2B of the UBC, where seismic zones 3 and 4 have been assigned for nearby areas characterized by Basin and Range style of normal faulting.

A sizable earthquake occurring in the vicinity of INEL in the foreseeable future is unlikely because of several factors. The Snake River Plain and the Basin and Range Province within about 25 miles of it have very low occurrences of seismic activity. The Basin and Range structures do not extend into the Eastern Snake River Plain, which shows little evidence of Quaternary faulting except for rift zones associated with basaltic volcanism (Figure 3.9-5). Thus, it appears that the Eastern Snake River Plain responds very differently to the regional tectonism than does the adjacent Basin and Range Province as demonstrated by the historical seismicity of the INEL region (Figure 3.9-4). A boundary fault has been postulated along the northwestern margin of the Eastern Snake River Plain but no evidence of any movement over the past 6.5 million years has been observed.

A deterministic seismic hazard analysis was conducted for all facilities at INEL to estimate peak ground accelerations (i.e., the strongest likely shaking from an earthquake) using site-specific information about the closest earthquake source and subsurface stratigraphy at INEL (Woodward-Clyde Consultants, 1990). Ground motion estimates have been modeled for a magnitude 7.3 earthquake (representing the 1983 Borah Peak earthquake) that has been assumed to occur along the southern portion of the Lehmi Range Front fault, approximately 7 miles northwest of CTF near the town of Howe. Estimates of peak horizontal ground accelerations (PHGA) for the CTF, using the assumed earthquake, were calculated to be approximately 0.25 gravities (for a site with rock at the surface) and 0.40 gravities (for a site with soil at the surface). All of these ground accelerations are low enough that buildings can be designed to minimize structural effects.

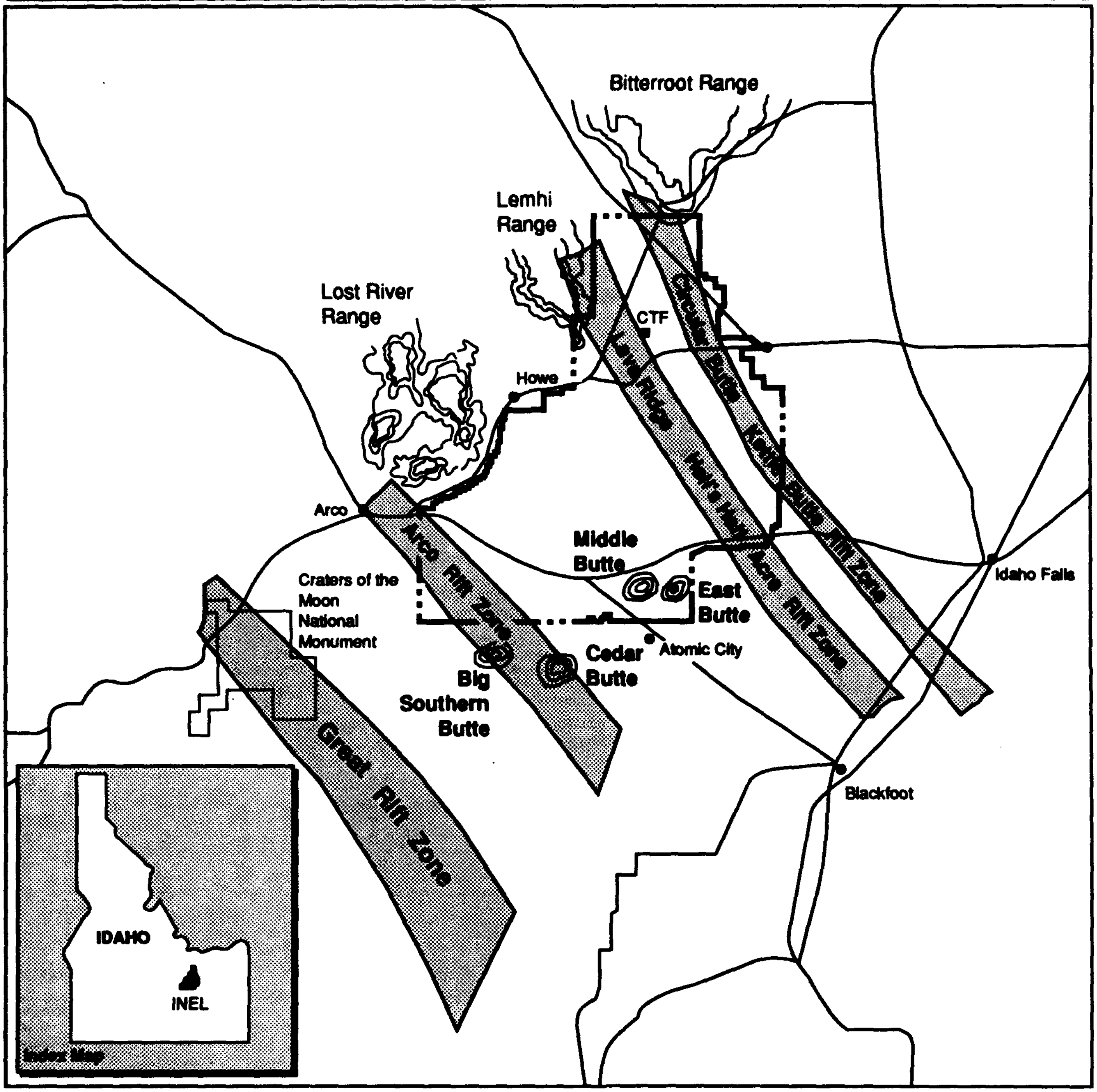
3.9.2.3 Volcanic Activity. Two major stages of volcanic activity have occurred in the Eastern Snake River Plain over the past 15 million years. Massive deposits of ash-flow tuffs at depth reflect an earlier stage of explosive volcanism from several major eruptive centers within the plain. Over geologic time, the centers of explosive volcanism have migrated progressively to the northeast and are now located in the Yellowstone Plateau nearly 125 miles away. This pattern is consistent with the geologic theory of "hot spot" tracks. Volcanic activity is theorized to result when

tectonic plates move across hot spots deep in the earth's mantle (DOE, 1991a). Later stages of non-explosive volcanism, beginning about 4 million years ago and continuing to as recently as 2,000 years ago, produced a thick series of many overlapping basaltic lava flows that issued from many local vents and small craters. These basalt flows dominate the surface geology at INEL (DOE, 1991a). The basaltic volcanism is postulated to have originated in several northwest-southeast-trending rift zones (Figure 3.9-6).

A drill hole in the southern part of INEL was drilled in Spring 1984 to a depth of 185.6 meters. Reliable ages were obtained for seven of the nine lava flows encountered. The ages show that the eruptions took place between 641,000 and 233,000 years ago with an average recurrence interval of 51,000 years during that period of activity. The time interval since the last activity (233,000 years) is about 4.6 times the average recurrence interval and 3 times the largest recurrence interval. These data suggest that the sources of basaltic lava at INEL are no longer active and, therefore, are not expected to erupt again (DOE, 1991a). Additional studies on the potential for volcanic hazards for this site on the southern end of INEL identified preliminary probabilities of hazard from a basaltic lava flow to be less than 0.00001 (1×10^{-5}) per year; probabilities of hazard for other volcanic events would be even less (Smith et al., 1990). Although volcanic hazard at the CTF would be somewhat different than these studies (e.g., lava flow probability would be slightly higher, because of the proximity of the Arco rift zone and because the CTF is in a topographic low, so that basalt could flow down onto it), it is likely to be similar.

The CTF site is located between two volcanic rift zones and is underlain by basaltic flows. There are two prominent inactive volcanic craters within six miles of the CTF.

3.9.2.4 Soils. The area that includes the CTF is underlain mostly by unconsolidated lacustrine deposits (see Figure 3.9-3). These deposits consist mainly of sandy and clayey silts. Remnants of ancient bars, spits, and beaches that form low ridges consist mainly of sand; the largest such ridge forms a natural north-south-trending embankment through the Technical Service Facility. Alluvial deposits flanking Birch Creek in the north consist of gravel, sand, and silt that provide the best source of sand and gravel for construction use in the area. Basaltic bedrock underlies the facility starting at depths of about 30 feet. The unconsolidated lake-bed deposits provide suitable natural foundations for light structures, but heavy structures must be supported on bedrock. The finer-grained soils (silts and clays) can be susceptible to wind erosion during and after ground-disturbing activities.



EXPLANATION

INEL Boundary

0 5 10 20 Miles

Idaho National Engineering Laboratory

Volcanic Structures and Rift Zones

Figure 3.9-6

3.10 NOISE

Noise is defined as "unwelcome or unwanted" sound that is usually caused by human activity and added to the natural acoustic setting of a locale. It is further defined as sound that disrupts normal activities or that diminishes the quality of the environment. There are two types of sound sources: stationary and transient. Stationary sources are typically related to specific land uses (e.g., industrial plants); transient sources move through the environment either along established paths or randomly (railroads, roads, flight tracks, etc.). The total acoustical environment of a location is the blend of the background, or ambient acoustics, with the unwanted noise.

Noise is described in terms of sound levels, the measurement of which is usually performed using adjusted decibels (dBA). Typical levels are shown in Figure 3.10-1.

3.10.1 SMTS

The major sources of noise at NTS are natural physical phenomena from weather and wildlife activities; transient noise is generated by aircraft overflight. Due to the remoteness of the area, and because nuclear testing is conducted underground, noise levels at NTS are minimal.

Because the area is remote, noise levels at the SMTS are primarily generated by the natural environment (wind, rain, and the activities of wildlife); noise generated from aircraft overflight is transient. The range for ambient noise levels in this type of remote desert area is between 22 and 38 dBA. The closest sensitive community receptors to the SMTS (e.g., hospitals, schools, and residences) are located approximately 23 miles away at Lathrop Wells; the closest NTS personnel that could be affected by noise levels are located approximately 6 miles away.

3.10.2 CTF

Major noise sources within INEL include various facilities equipment and machines (e.g., cooling towers, transformers, engines, pumps, steam vents, construction and materials handling equipment, and vehicles).

Since the CTF currently performs no routine facility operations, noise levels are similar to that of the SMTS. Some vehicular traffic noise is produced by the small staff performing the decontamination and decommissioning activities; however, that noise, and that generated from aircraft overflight, is transient. Typical ambient noise levels at the CTF site would be below 40 dB. The closest sensitive community receptors to the CTF (e.g., hospitals, schools, and residences) are located approximately 11 miles away in Mud Lake. The closest INEL personnel are located in other portions of the TAN (approximately 1.3 miles away).

Figure 3.10-1
Typical Noise Levels of Familiar Sources

	dBA	
	145	
Physically Painful	140	Sonic Boom
Extremely Loud	135	
	130	
	125	Jet Takeoff at 200'
Discomforting	120	Oxygen Torch
	115	Discotheque
	110	Motorcycle at 15' (Unmuffled)
	105	Power Mower at 3'
Very Loud	100	Newspaper Press
	95	Freight Train at 50'
	90	Food Blender
	85	Electric Mixer, Alarm Clock
	80	Heavy Truck at 50'
	75	Busy Street Traffic at 50'
	70	Average traffic at 100', Vacuum Cleaner at 10'
Loud	65	Electric Typewriter at 10'
	60	Dishwasher at 10', Air Conditioning Unit at 10'
	55	Normal Conversation at 5'
	50	Typical Daytime Suburban Background
	45	Refrigerator at 10'
	40	Bird Calls
	35	Library
	30	Room in Quiet Dwelling at Midnight
Quiet	25	
	20	Motion Picture Studio
	15	
	10	Leaves Rustling
	5	
Threshold of Hearing	0	

3.11 WATER RESOURCES

Water resources include underground and surface sources of water for the area, and water quality. Generally, the region of influence for water resources is the hydrologic system of the area. More specifically, the region of influence is the source of the water (e.g., stream, river, lake, reservoir, groundwater basin) supplied to each alternative site.

3.11.1 SMTS

The hydrology of NTS has been studied intensively since the mid-1950s, and water quality in and around the site has been monitored since underground nuclear testing began. The U.S. Geological Survey, U.S. EPA, and the Desert Research Institute have conducted most of these studies.

Groundwater

The groundwater hydrologic systems of the southern Great Basin are characterized by deep water tables and closed groundwater basins that may not correspond to topographic basins. Recharge occurs predominantly by slow percolation from upland areas through the unsaturated zone that overlies the water table. Groundwater in the region occurs chiefly in fracture zones in at least six major aquifers at various levels within limestone, dolomite, and volcanic rock units. The aquifers are commonly isolated from each other by aquitards, relatively impermeable layers that act as a barrier to groundwater movement. In addition, groundwater flow is commonly blocked or diverted by faults and in places where the groundwater reaches the surface as flowing springs. In the deeper aquifers, the water is under artesian pressure. Principal recharge areas for the bedrock aquifers are upland areas and mesas to the north.

Water use in Nevada is governed by the office of the State Engineer and the Division of Water Resources. Chapter 534 of the Nevada Water Laws outlines and delineates the allowable uses of groundwater. Total annual groundwater withdrawals from any given basin may not exceed the perennial yield. Data collected from wells in Areas 3, 5, and 6 of NTS indicate that there has been no detectable decline in the static water level and, therefore, no exceedance of perennial yield for the aquifer(s) at these locations (DOE, 1988g) (see Figure 3.2-1). Total withdrawals from wells C and C-1 located in Area 6 of NTS were 26 million gallons per year (0.07 million gallons per day [MGD]) (DOE, 1988g).

In the Mid Valley area, groundwater occurs only in deep bedrock aquifers; the alluvial deposits may contain water following rains but do not form perennial aquifers. Groundwater in the proposed water-supply well occurs in tuffaceous aquifers that are probably isolated from the deeper limestone and dolomite aquifers. The static water level in this well is at a depth of

1,663 feet below the surface; the well head is at an elevation of 4,346 feet MSL.

Groundwater in the Mid Valley area is believed to be part of the Ash Meadows subbasin (see Figure 3.2-1). There are 11 NTS wells that currently withdraw water from the Ash Meadows subbasin and three that withdraw water from the Alkaline Flat-Furnace Creek Ranch Subbasin.

Surface Water

Surface water in the southern Great Basin occurs principally in interior drainage systems characterized by a dense network of intermittent streams that flow into closed topographic basins known as playas. Typically this water stands on the playas for several days to a few weeks before it is lost, mainly by evaporation. There are 13 playas within a radius of 50 miles of the proposed SMTS site.

There are no perennial sources of surface water in the Mid Valley area. The alluvial fan on which the proposed SMTS site is located is cut by many shallow boulder-dry stream beds that contain water only during and shortly after occasional heavy rains. During rare flash floods, streams may be diverted by sediment and cut new channels into easily eroded alluvial deposits. There is, however, no evidence of such flash flooding in the channels bordering the proposed site. Runoff from precipitation at the proposed site drains into the normally dry Barren Wash, which is part of an interior drainage network that terminates in Frenchman Flat, a playa in a closed topographic basin about 16 miles to the east.

Water Quality

Groundwater from the tuffaceous aquifers such as those in the proposed water supply well is generally of excellent chemical quality. It is characterized by relatively high concentrations of sodium and potassium carbonates and low acidity. In general, water in the tuffaceous aquifers meets U.S. EPA primary and most secondary standards for harmful constituents (DOE, 1986) regulated under the Safe Drinking Water Act.

The deep aquifers, slow groundwater movement, and exceedingly slow downward movement of water in the overlying unsaturated zone serve as barriers to transport of radioactivity from underground sources (e.g., underground testing) via groundwater, preventing movement of radioactivity to off-site areas for thousands of years. The estimated average velocity of groundwater flow through the lower carbonate aquifer in central Yucca Flat is 6 to 600 feet per year (DOE, 1990d).

Groundwater is the only local source of drinking water in the NTS area. Drinking and industrial water-supply wells for NTS are produced from the

lower and upper carbonate aquifers, the volcanic aquifer, and the valley-fill aquifer. Though a few springs emerge from perched groundwater lenses at NTS, discharge rates are low, and spring water is not currently used for DOE activities. South of NTS, private and public supply wells draw water from the valley-fill aquifer.

Groundwater sampled from a borehole approximately 20 miles southwest of the SMTS had a pH of 7.7, 216 milligrams per liter (mg/l) of dissolved solids, and relatively high concentrations of silica (45 mg/l), sodium (57 mg/l), and bicarbonate (143 mg/l).

There are no known incidents of groundwater contamination (e.g., fuel spills, solvents) in the vicinity of the SMTS location.

3.11.2 CTF

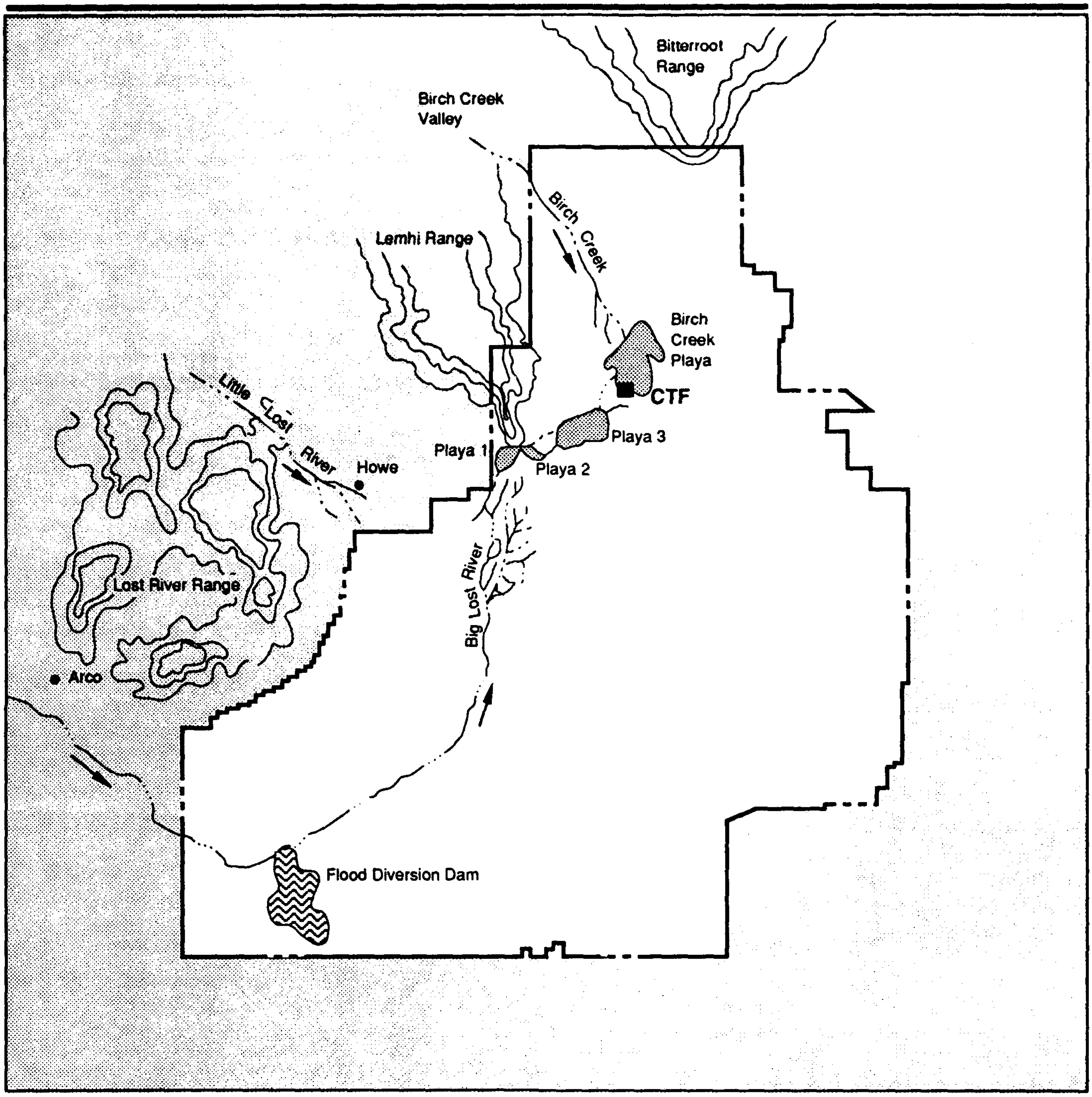
Groundwater

Large volumes of groundwater occur in the bedrock aquifer beneath the Snake River Plain. The water occurs chiefly in fractures and voids in the basaltic lava flows that underlie the plain. In INEL, the groundwater flows to the south and southwest and discharges about 6.5 million acre-feet (1 acre-foot equals approximately 326,000 gallons) annually to springs that feed the Snake River below Twin Falls, 100 miles from INEL. Groundwater flow rates range from 5 to 20 feet per day. Depth to the water table ranges from about 200 feet in the northeast to 1,000 feet in the southern part of INEL. Recharge to the Snake River Plain aquifer is primarily by infiltration from streams to the northwest, north, and northeast of INEL, especially the Big Lost River.

The DOE Idaho Field Office has negotiated with the Idaho Department of Natural Resources a claimed water right for 81 cubic feet per second, not to exceed 1.5 billion cubic feet (approximately 11 billion gallons) per year withdraw capacity under the Federal Reserve Doctrine. The state of Idaho has signed a Settlement Agreement, public hearings have been held, and based on these hearings, an Interlocutory Order will be generated. INEL will abide by this Order as it affects water use until the adjudication process is complete. Currently, INEL withdraws up to 6 MGD, with an average of 37 million gallons per year (DOE, 1991a).

Surface Water

The surface water hydrology of the INEL is dominated by the Pioneer Basin, a closed drainage basin that receives water from Big Lost River, Little Lost River, and Birch Creek (Figure 3.11-1). These rivers are supplied by mountain watersheds located to the north and northwest.



EXPLANATION

Playa

Water Diversion Area

Flow Direction

0 2 4 8 Miles

Idaho National Engineering Laboratory

Surface Water Features

Figure 3.11-1

The Big Lost River is the major river on INEL. This river flows intermittently onto the INEL site across the southwest boundary, curves to the northeast, and terminates at the Big Lost River playas (sinks). Surface flows last occurred in 1986. The major storage and diversion structures on the Big Lost River are the Mackay Dam and the INEL flood diversion dam.

Under normal conditions, most of the flow from the Little Lost River and from Birch Creek is diverted for irrigation before reaching the INEL. In high-flow years, however, Little Lost River and Birch Creek flow onto the site. There, the remaining water evaporates or infiltrates into the ground through the stream channel or playa bottom (DOE, 1984a, 1984b). Because of the upstream diversions of water, flooding under normal conditions does not occur within INEL. A maximum possible flood resulting from maximum flows combined with upstream dam failure would inundate the entire Big Lost River floodplain as well as the playas in which the river terminates.

The INEL flood diversion system consists of a small dam that functions to divert the river flow away from INEL facilities into four spreading areas.

The CTF and the entire TAN are located within the margins of the Birch Creek playa. The playa is the terminus of both Birch Creek and Big Lost River, and has a minimum elevation of approximately 4,775 feet MSL. The playa is normally dry and contains discontinuous shallow pools of water only for short periods after heavy rains. Because of the upstream diversions for irrigation, waters from Birch Creek and Big Lost River do not reach the playa under normal conditions. Maximum flow conditions in these streams combined with the failure of water control structures, however, would flood the playa. Flood control facilities, consisting of low dikes and interconnected drainage ditches, have been constructed in the CTF area to prevent flooding of the CTF (EG&G Idaho, Inc., 1986). Section 3.9.2.1 contains additional discussion on floodplains.

Water Quality

Groundwater quality from drinking water wells on INEL meets drinking water standards (DOE, 1991a). The average total dissolved solid content at INEL is low, ranging from 200-255 mg/l and consists mainly of calcium, magnesium, sodium, and potassium. The composition of the groundwater indicates reaction with minerals in rocks of the surrounding mountains and alluvial valleys where the residence time of the groundwater is relatively long. In addition, levels of radioactive constituents from several INEL wells are well below EPA standards.

Waters from the Snake River Plain aquifer on INEL are relatively low in the sum of dissolved constituents (about 200 mg/l). The low mineralization reflects the moderate to abundant precipitation in the mountainous source areas, the absence of extensive deposits containing highly soluble minerals

and the low solubility of the basaltic rocks that form the principal aquifer system. The water in the aquifer has a low dissolved solid content and, with little or no treatment, is suitable for most uses. There are some areas in the Snake River Plain aquifer where water quality exceeds regulatory standards; the excess concentrations have been decreasing over the last 20 to 30 years. INEL was placed on the NPL during 1989 to facilitate remediation and monitoring of contaminated areas including an injection well located at TAN in close proximity to the CTF.

3.12 HEALTH AND SAFETY

3.12.1 Existing Safety, Security, and Radiological Monitoring Systems

This section presents background information concerning existing conditions at both NTS and INEL. This includes security and fire protection, operational safety and emergency response procedures, and the existing radiological conditions and monitoring systems. The regions of influence for health and safety are the areas surrounding the alternative test sites which could be affected by test operations or credible accidents, and the area along transportation routes used for shipment of project-related materials. The areas within 150 km of each test site were analyzed for radiological effects.

3.12.1.1 NTS

Public Safety

NTS is a limited access, controlled facility with public access prohibited. It is bordered on three sides by the Nellis Air Force Range. Road access to NTS is restricted by guard stations and barricades. Mobile patrols are employed to provide security throughout NTS. All personnel on NTS are required to wear identification badges containing a thermoluminescent radiation dosimeter, which is used to measure the amount of ionizing radiation each individual might receive while on site.

All air traffic over NTS is restricted and the airspace is monitored by radar; any unauthorized aircraft can be intercepted by Air Force aircraft and escorted to the Desert Rock Airport, three miles south of Mercury, Nevada, for purposes of identifying the pilot and his intentions. The airspace over the Nellis Air Force Range is also restricted. Emergency procedures have been set up so that an inadvertent large release of radioactive gas from an underground nuclear event would not endanger air traffic. Communications systems are in place so that, if needed, air route traffic controllers would be notified of the location of the radioactive cloud and they, in turn, could re-route air traffic as required.

The Nye County Sheriff's office is the primary law enforcement entity on the site and has authority to control ground traffic and make arrests. An

office is maintained at Mercury, Nevada, and the sheriff's deputies are authorized to enter most facilities on the site for law enforcement purposes. The State Police and the Federal Bureau of Investigation are not represented on the site; however, they respond to calls for assistance from either the Nye County Sheriff or the NTS Security Organization.

NTS maintains a contractor security force to ensure necessary protection for government property; transport, handling, and protection of special nuclear material; and response to sabotage, espionage, terrorist activities, or other hostile acts. Security personnel are trained in methods for the safeguarding of special nuclear materials and are equipped with armament, weapons, and specialized transportation to effectively deal with hostile threats. In addition, the NTS security force is deputized by Nye County to assist in law enforcement activities.

Temporary roadblocks are established when needed to control access to designated testing areas in connection with the detonation of underground nuclear devices. The designated forward areas usually include all areas north of Control Point 1 (CP-1), the command and control center for nuclear testing at NTS (see Figure 2.3-2). These areas are "swept" by guard patrols to assure that all personnel have withdrawn to a designated safe location. Helicopters and light aircraft are available to the security force and are normally used to check perimeter barricades and other remote locations in the forward test areas as a part of this sweeping action.

DOE/NV maintains a fully equipped fire department at NTS which is staffed by professional fire fighters and augmented by fire protection engineering personnel. There are two fire stations (Mercury and Area 6), with a complement of nine fire apparatus ranging from structural to aircraft crash rescue. In addition, rescue, mobile command post, and all-terrain vehicles are available. Additional assistance can be requested from other fire departments as provided for in Memorandums of Understanding with the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service.

DOE/NV maintains an Emergency Operations Center (EOC) in Las Vegas, Nevada, which provides oversight during emergencies at all installations under their jurisdiction, including NTS. The EOC provides long-term communications and coordination with emergency response resources. It is staffed with trained and experienced personnel and is equipped with facsimile machines, computer networks, radios, cellular phones, and other state-of-the-art communications equipment (DOE, 1988e).

CP-1 coordinates all operational activities at NTS. In addition to exercising control authority associated with underground testing, it maintains an elaborate communications and data acquisition network to support event-based testing.

Under DOE auspices, EPA has established an off-site environmental surveillance network, currently including 19 Community Monitoring Stations. Each station has a suite of samplers and recorders, including a pressurized ion chamber (PIC). All of these monitoring stations are equipped to telemeter PIC information via satellite directly to a Control Point on NTS. Each of these stations is managed by a member of the community in which the station is located, usually a science teacher from the local school system.

The BLM has a large automated network of meteorological stations telemetering data by satellite. These stations are sited on a roughly 75-mile grid covering most of the western U.S. The EPA, in an agreement with BLM, has instrumented 10 of these stations with PICs to collect external gamma exposure rate data. The system also provides a broad spectrum of meteorological data from a significant number of stations for use by the Weather Service Nuclear Support Office (WSNSO) in radioactive cloud transport/dispersion assessments.

WSNSO provides all meteorological services required on NTS. It carries on investigations and research into meteorological processes, prediction methods, and fallout phenomenology. It also researches data acquisition, processing, and display techniques for improving meteorological support to assist the DOE in performing its mission. WSNSO is responsible for conducting a broad meteorological program in support of both nuclear and non-nuclear projects.

During a nuclear test, additional resources are deployed in and around NTS to provide increased radiological monitoring capability. These include:

- A Bluebird Team consisting of monitoring personnel with appropriate radiation detection instruments to provide close-in radiological monitoring of any potential effluent

- EPA Monitors at standby locations in or near the estimated off-NTS downwind fallout locations, determined prior to the event. If a radioactive release occurs, these mobile monitoring personnel are positioned to perform off-site radioactive monitoring and sampling

- Aircraft, including a helicopter and fixed-wing aircraft, with radiological monitoring capability can be deployed for each nuclear event.

A 24-hour-per-day Radiological Assistance Team with support from numerous DOE, contractor, and user agency personnel is available. DOE/NV is also DOE's Federal Radiological Management and Assessment Center (FRMAC) lead field office which coordinates all federal agency response to a significant radiological emergency. DOE/NV also manages the Nuclear

Emergency Search Team which maintains extensive aerial and ground radiological monitoring capability.

Safety documentation is written, as necessary, to support operations conducted at NTS. The sponsoring laboratory or agency provides an operations plan that covers safeguards and security, and radiological, environmental, and personnel safety. An Operations Permit is issued once radiological, environmental, health, safeguards, and security concerns are satisfied.

Environmental Radiation Monitoring

DOE is responsible for providing radiological safety services on the NTS and maintaining an environmental surveillance program designed to control, minimize, and document exposures to the NTS working population and the off-site public population. The results are reported annually in environmental reports (DOE, 1990d).

Documented standard operating procedures have been established for radiological monitoring conducted at NTS (DOE, 1988c). The NV/YMP Radiological Control Manual for NTS (DOE, 1992h) outlines standard operating procedures for radioactive materials control, shipment of radioactive material, radiological safety in specific test areas, and waste management.

Under an Interagency Agreement with DOE, U.S. EPA conducts the off-site radiological monitoring program around the NTS. The routine surveillance program includes pathways monitoring that consists of air, water, and milk surveillance networks surrounding NTS, and a limited animal and vegetable sampling program. The EPA's extensive off-site environmental surveillance system around NTS has measured no radiological exposures that can be attributed to current NTS operations.

The Off-Site Radiological Safety Office (EPA/EMSL) is responsible to the Test Controller and the NTS Manager for providing off-site radiological safety services in accordance with NTS-SOP 5402 and the Interagency Agreement (DE-AI08-86-NV10522). Emergency preparedness responsibilities are established as outlined in DOE Orders 5500.2 and 5480.1A, along with NTS-SOP 5501 (SNL, 1989). All essential test-related personnel receive basic radiological safety training and any additional training required for their job assignments.

3.12.1.2 INEL

Public Safety

INEL is a limited access, controlled site that significantly limits the presence of the general public anywhere within the interior portions of the site and from access to the nuclear facilities. Access by visitors to and from individual sites is controlled at all times and only those authorized are allowed on site; everyone entering must have an appropriate security badge. All personnel and visitors entering any nuclear facility receive a thermoluminescent radiation dosimeter while in the area, which is used to determine the amount of ionizing radiation that each individual might receive while on site.

The airspace over INEL is designated by the FAA as a National Security Area, and access is limited to above 6,400 feet MSL. Communication systems are in place so that air route traffic controllers can advise the local transient aircraft of abnormal conditions in the area.

INEL maintains a contractor security force to ensure necessary protection for government property; transport, handling, and protection of special nuclear material; and response to sabotage, espionage, terrorist activities, or other hostile acts. Security personnel are trained in methods for the safeguarding of special nuclear materials and are equipped with armament, weapons, and specialized transportation to effectively deal with hostile threats. The security forces are also equipped with two helicopters for INEL patrol, including pre-test surveillance and clearing of restricted test areas. In addition, the INEL security force is deputized by the adjacent counties to assist in law enforcement activities. The state and federal roads that cross INEL are patrolled and enforced by the Idaho State Patrol and the local county sheriffs' offices.

Access to the grazing areas around INEL is monitored and patrolled by the INEL security force to ensure the grazing boundaries are honored and maintained. The central portion of the INEL is also frequently swept for unauthorized access. The nuclear facilities, including TAN and the CTF, are patrolled 24 hours a day.

INEL maintains a well-trained and fully equipped fire department. There are 3 fire stations (TAN, CFA, and ANL-W sites), equipped with a total of four engines, one tanker, three brush fire fighting units, one rescue unit, and several other vehicles for brush fire response. Additional assistance can be requested from community fire departments, as provided for in Memorandums of Understanding with the BLM and local communities.

The INEL EOC serves as the center for oversight of emergencies at the INEL, providing for long-term communications with off-site agencies, and for

coordinating INEL resources in response to requests by off-site authorities. The EOC is staffed with trained and experienced personnel and is equipped with facsimile machines, computer networks, radios, cellular phones, and land-line telephones.

INEL has an around-the-clock quick response field monitoring team to provide timely measurement and reporting of release to the environment of radiological materials. This initial quick response capability is backed up by a second phase response of multiple field monitoring teams. The teams use standardized and state-of-the-art equipment in their response. The INEL field monitoring teams are integrated in their response with the INEL-implemented Region Six Radiological Assistance Programs and other national response teams such as the Nuclear Emergency Search Team and the Accident Response Group. A Mobile Emergency Response Van equipped with communications, radiological monitoring, and gamma spectroscopy equipment is included in the radiological response capabilities at INEL. Specialized alpha radiation monitoring equipment and personal protective equipment are also available.

Individual Safety Analysis Reports (SARs) are written for each reactor facility at INEL (see Section 4.12.1). The sponsoring laboratory or agency provides radiological safety plans for each test series which cover all operations. They include radioactive effluent documentation, surveys for radiological safety, cleanup and pollution control procedures, instrumentation types and deployment, and any other radiological safety features pertinent to operations at INEL.

Environmental Radiation Monitoring

Environmental monitoring programs at INEL are conducted by DOE to determine (1) the overall impact of operations on the environment, (2) whether environmental levels of radioactivity comply with applicable standards (40 CFR 61, DOE Order 5400.5), (3) whether containment and control systems at facilities are functioning as planned, and (4) long-term trends of concentrations of radioactivity in the environment and any changes in those trends. Environmental impacts are determined by measuring radionuclides in the environment, where such measurements are possible, or by modeling the transport of radionuclides through environmental pathways in cases where environmental concentrations are too low to measure. Measurements on INEL or at the INEL boundary are frequently compared to similar measurements at background or control locations. Where radionuclide concentrations are high enough to be measured regularly, long-term trends are presented. Data are reported yearly in an environmental monitoring report for the INEL (DOE, 1990b).

The environmental pathways by which radioactivity could affect the population in the vicinity of INEL are through direct radiation exposure,

through atmospheric transport, and through soils, water, foodstuffs, and/or animals. The environmental monitoring program for the INEL site and vicinity includes the collection and analysis of samples from these potential exposure pathways.

Air and water are routinely monitored for radioactivity at a number of on-site, boundary, and distant locations. Concentrations of radionuclides in milk, wheat, and lettuce samples are measured at site boundary and distant locations. Distant locations serve as background controls that are not affected by radioactive releases associated with INEL operations. On-site soils are sampled annually on a rotating basis, while off-site soils are sampled only in even-numbered years. Environmental radiation exposure rates are measured at the site boundary and at distant locations. Based on available monitoring data, no significant concentrations of radionuclides from INEL have been detected.

3.12.2 Environmental Radiation

A large contributor to existing radiation exposure in the environment (experienced normally due to both natural and man-made exposure) comes from background sources, which include cosmic radiation, naturally occurring terrestrial radioactive materials, and natural internally deposited radioactive materials (e.g., carbon-14 naturally found in biological systems). These sources account for a large part of radiation exposure received by every individual on an annual basis, and can vary from location to location depending upon such factors as elevation of an area (increased cosmic radiation) and the presence of varying amounts of mineral deposits (increased terrestrial radiation). An individual can do little to influence the exposure received from background sources, since levels are essentially constant throughout a given region, and are not affected by lifestyle choices. At NTS, background sources contribute a total whole-body dose of 125 millirems per year (mrem/yr), while at INEL they contribute a total whole-body dose of 144 mrem/yr. In addition to the background sources, several other sources of radiation can influence the total individual whole-body dose. Exposure due to these sources can vary from individual to individual, based upon lifestyle choices. Since annual exposure from such sources needs to be included in determination of the existing radiation exposure, the average exposure to a U.S. resident from each of these sources has been determined, and includes medical and dental X-rays (53 mrem/yr), global nuclear weapons test fallout (4.6 mrem/yr), various consumer and industrial products (1 mrem/yr), and air travel (1 mrem/1,000 miles) (Glasstone and Sesonske, 1981). Finally, radon gas naturally present in the environment contributes an exposure of 200 mrem/yr to the average person in the United States (NCRP, 1987), but again, this value can vary greatly from individual to individual based upon such factors as housing type, climate and local soil mineral content. Together the contribution of all these sources produce the environmental

radiation exposure received by each individual. In the vicinity of NTS, a person typically receives an environmental dose of approximately 383 mrem/yr, while at INEL a person typically receives an environmental dose of 402 mrem/yr.

Both NTS and INEL host ongoing activities which could result in the release of small quantities of radioactive material. At NTS, these include underground testing of nuclear weapons, and wastes generated by NTS activities. If instituted after completion of site characterization, very small levels of release may occur from the Yucca Mountain Nuclear Waste Repository. The dosage received by any individual in the vicinity of NTS as a result of airborne releases from these activities is reported annually based upon computer modeling results (in accordance with NESHAP requirements) and verified using environmental monitoring program data, and is much less than 1 mrem (DOE, 1990d). At INEL, release of small quantities of radioactive materials could result from operation of nuclear reactors, and wastes generated by INEL activities. The dosage received by any individual in the vicinity of INEL as a result of this activity is also reported annually (in accordance with NESHAP requirements), and is also much less than 1 mrem (DOE, 1990c). In both cases, from current activities, the reported maximum individual dose is well below the permissible NESHAP limit of 10 mrem/yr, and impacts associated with each site represent unmeasurable increases above that to which the general public can reasonably expect to be exposed.

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4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter discusses the potential environmental consequences associated with implementation of the Proposed Action at the two alternative sites, as well as the consequences of the No-Action Alternative. To provide the context in which potential environmental impacts may occur, discussions of potential changes to land use, transportation, and community and public utility services are included in this Environmental Impact Statement (EIS). In addition, issues related to current and future management of hazardous materials and wastes are discussed. Impacts to the physical and natural environment are evaluated for air quality, biological resources, cultural resources, geology and soils, noise, water quality and health and safety. These impacts may occur as a direct or indirect result of program activities. In addition, actions that could contribute to potential cumulative impacts to the environment (Section 2.7) were considered.

Means of mitigating adverse environmental impacts that may result from implementation of the Proposed Action at the two alternative sites are discussed. Mitigation measures are suggested for those components likely to experience substantial and adverse changes under these alternatives.

4.1.1 Local Community

This section discusses the potential effects on the two identified regions of influence as a result of implementation of the Proposed Action. The effects of implementing the particle bed reactor (PBR) validation testing include those on population and employment.

4.1.1.1 Saddle Mountain Test Station (SMTS). It is estimated that a maximum of 263 persons would move into the area as a result of this project being implemented. This represents an increase of less than 0.04 percent in the region of influence population. For modeling purposes, this estimation is based on a peak year increase of 100 employees (direct jobs) and assumes for purposes of determining maximum impact that no persons from the local job market would be employed. A dependent factor of 2.63 is included with each direct job, to include families and other dependents associated with these employees (1990 U.S. Census Data). No secondary employment positions were modeled in this analysis.

Direct employment would result in a 2 percent increase in total peak year employment at the Nevada Test Site (NTS), to a total of approximately 5,100.

4.1.1.2 Contained Test Facility (CTF). It is estimated that a maximum of 263 persons would move into the area as a result of this project being implemented. This represents an increase of 0.2 percent in the population of the region of influence. For modeling purposes, this estimation is based on a peak year increase of 100 employees (direct jobs) and assumes for purposes of determining maximum impact that no persons from the local job market would be employed. A dependent factor of 2.63 is included with each direct job, to include families and other dependents associated with these employees (1990 U.S. Census Data). No secondary employment positions were modelled in this analysis.

Direct employment would result in an increase of less than 1 percent in total peak year employment at Idaho National Engineering Laboratory (INEL) to a total of approximately 11,700 jobs.

4.2 INFRASTRUCTURE

4.2.1 SMTS

4.2.1.1 Energy. The added distribution line connecting the SMTS to the 1.5 megawatt (MW) NTS electrical distribution line 2.4 miles to the north would provide sufficient electrical power to meet the sub-scale facility (PBR Integral Performance Element Tests [PIPET]) peak power requirements of 0.75 MW over a duration of a few hours. Supplemental power would be provided with mobile generators to support high demand for short periods of time during ground test article (GTA) operational testing.

4.2.1.2 Solid Waste. It is estimated that the amount of non-hazardous solid waste generated from this project would equal an average 175 tons per year over the life of the project. At NTS, this amounts to less that 2 percent of the total amount of solid waste deposited on an annual basis. The increase in solid waste demand would result in a negligible decrease in the anticipated 10-year lifespan of existing NTS solid waste disposal capacity.

4.2.1.3 Wastewater. Typical freshwater consumption in an industrial setting is approximately 40 gallons per employee per day (Clark et al., 1971). This value has also been used to estimate wastewater production. The total amount of wastewater produced would be approximately 2,400 gallons per day at the site. An on-site septic system would be constructed to accommodate this wastewater. A state of Nevada permit to construct and operate the system would be required.

4.2.1.4 Water Supply. The water supply for the construction (16 million gallons) and operation (3 million gallons per year) of the test site would increase withdrawal at NTS by approximately 0.01 million gallons per day (0.5 percent). Because withdrawal from other wells on NTS is considerably

larger than the PBR validation test requirement, this represents a small increase in demand on the water supply system. As discussed in Chapter 2, the exploratory well would need to be equipped with pumps, etc., to be converted to a production well. Also, a water supply pipeline connecting the well and the SMTS would be required. A state of Nevada permit to construct and operate the water system would be required.

4.2.1.5 Mitigation Measures. Because impacts to infrastructure from the SNTP program at the SMTS are not anticipated, no mitigation measures would be required.

4.2.2 CTF

4.2.2.1 Energy. The INEL electrical distribution system is adequate to handle most PIPET and GTA test requirements due to the existing developed nature of the area. The SNTP requirement of 0.75 MW during tests would represent a 2.5 percent increase in peak demand at the Test Area North (TAN); average increase would be less than 1 percent. Mobile generators may be required to provide supplemental power during peak demands of the GTA testing operations.

4.2.2.2 Solid Waste. It is estimated that the amount of non-hazardous solid waste generated from this project would average 175 tons per year over the life of the project.

The amount of municipal wastes generated by the small operating staff at the CTF would be a small percentage of total municipal waste. Impacts to solid waste management from industrial or construction waste generated from SNTP program implementation at the CTF is expected to be similar to those described for NTS. These facilities are expected to have sufficient capacity to support the SNTP program.

4.2.2.3 Wastewater. Typical freshwater consumption in an industrial setting is approximately 40 gallons per employee per day (Clark et al., 1971). This value has also been used to estimate wastewater production. The total amount of wastewater produced would be approximately 2,400 gallons per day at the site.

The existing sewage system for the CTF consists of a series of evaporation ponds with a total holding capacity of approximately 16 million gallons. Present production of wastewater is approximately 8,000 gallons per day. The 2,400 gallons per day of wastewater generated by the SNTP program, in addition to the 8,000 gallons per day of baseline use (an increase of 30 percent), would place the septic tank at 30 percent of its total capacity. The total amount of SNTP and baseline wastewater (10,400 gallons per day) is well below the capacity of the evaporation ponds.

4.2.2.4 Water Supply. The 0.01 million gallons per day of water required for the construction and operation of the test site would represent 0.1 percent of the volume of water allocated to INEL. Because INEL uses a maximum of 12 percent of its allocation, this additional demand could easily be met.

4.4.2.5 Mitigation Measures. Because impacts to infrastructure from SNTP activities at the CTF are not anticipated, no mitigation measures would be required.

4.2.3 No-Action Alternative

Because no construction would occur with the No-Action Alternative, no impacts to infrastructure would occur at either of the SNTP alternative sites.

4.3 LAND USE

4.3.1 SMTS

There would be no land use impacts at the SMTS. The change in land use at the SMTS from an unoccupied area to 100 acres of facilities for the proposed use as a nuclear propulsion test site is consistent with the NTS mission. The SMTS is sufficiently removed from other testing areas to preclude interference with underground testing and other NTS activities.

Construction of the PBR validation test facility would not result in any land use conflicts to adjoining areas as a result of construction of the facility. There is sufficient area for the establishment of safety buffer zones around the site.

Potential land use conflicts between the SNTP program and site characterization/potential site selection of the Yucca Mountain Waste Repository were analyzed. Siting guidelines for the waste repository (10 CFR 960) specify certain conditions for site selection. Potential issues related to land use compatibility were considered in terms of the siting guidelines. No SNTP activities are expected to impact the site characterization and potential site selection process of the waste repository.

Because impacts to land use from SNTP activities at the SMTS are not anticipated, no mitigation measures would be required.

4.3.2 CTF

The change in land use from CTF activities to SNTP activities would be compatible with other similar research and development operations at INEL. Depending on the final design of the propellant and coolant storage facilities, explosive safety zones may make facilities adjacent to the CTF (not being

used by the SNTP program) unfavorable for uses by other projects. In addition, SNTP program requirements for periodic evacuation of non-program-essential personnel for PBR testing may cause schedule conflicts with programs using nearby facilities, thus possibly reducing the useability of these other facilities while the PBR testing activities are in progress.

The land area that would be affected at the CTF site already has existing facilities which would be modified; additional expansion of less than 50 acres would also be required for a total project site of approximately 100 acres. The only impact caused by the additional facilities and related safety buffer zones in the expanded area would be the relocation of a National Oceanic and Atmospheric Administration (NOAA) meteorological tower. The tower could be moved within the disturbed area and would not adversely affect NOAA's data collection. Due to PBR testing activities, restrictions on grazing in the vicinity of the site may occur on an increasing basis.

Because impacts to land use from SNTP activities at the CTF would be minor, no mitigation measures would be required.

4.3.3 No-Action Alternative

Because no facility construction or renovation/modification of existing facilities would occur with the No-Action Alternative, no impacts to land use would occur at either of the SNTP alternative sites.

4.4 TRANSPORTATION

4.4.1 SMTS

4.4.1.1 *Transportation.* The transportation of construction and operations personnel to the SMTS would increase the one-way daily peak hour traffic on U.S. 95 from Las Vegas by a maximum of 100 vehicles during construction, and 60 vehicles during operations. Additionally, delivery of liquid hydrogen and other materials (via truck) would increase traffic by an average of 5 trucks per day (for a 10-year program). Because some employees would use car pools or buses, the actual increase in vehicles would probably be somewhat lower. The total traffic volume on U.S. 95 would increase by about 5.9 percent (3,600 average annual daily traffic [AADT]) during the construction phase, and by about 3.8 percent over baseline conditions, to 3,520 AADT during the operations phase. Because this segment of U.S. 95 is a four-lane divided highway, no adverse affects are expected from the increased traffic volume. As discussed in Chapter 2, Mine Mountain Road and Saddle Mountain road would be maintained to assure safe truck and operations traffic to the SMTS. Because of the small numbers of AADT generated by SNTP, and because of the availability of alternative access to the SMTS, SNTP traffic is not expected to affect the

Yucca Mountain site characterization process. Other existing NTS roads would not be adversely affected by the increased traffic volume.

4.4.1.2 Airspace. The plume generated from hydrogen flaring may cause sufficient heat and turbulence near the flare stack to affect aircraft flying through it. Due to the airspace restrictions in place at NTS, no commercial aircraft are likely to be in the vicinity of the PBR validation test facility during operations. Procedures are in place to restrict overflights of the test area by military aircraft during testing periods. These procedures would be followed for any PBR validation testing activities.

Mitigation Measures

Because adverse impacts to traffic to and from the SMTS site are not expected to result from SNTP activities, no mitigation measures would be required.

No special mitigation measures would be required to restrict airspace during testing operations beyond the existing controls and notification procedures.

4.4.2 CTF

4.4.2.1 Transportation. During peak construction, a maximum of 100 workers would be commuting to the CTF site at INEL. A maximum of 60 workers would be commuting during the operations phase. Additionally, delivery of liquid hydrogen and other materials (via truck) would increase traffic by an average of 5 trucks per day (for a 10-year program). The majority of these workers would be commuting from Idaho Falls, with smaller numbers commuting from other communities. The use of buses for transporting personnel from population centers to the sites at INEL is expected to continue, which would minimize increases in traffic volume resulting from SNTP operations.

Assuming that approximately 80 percent of workers would travel to INEL by bus on Idaho State Route 33, traffic during the construction phase would increase by about 4 percent, to about 552 AADT. Operations traffic would increase the traffic volume on State Route 33 by approximately 4 percent. No reduction in level of service on State Route 33 would be expected during the operations phase. No SNTP traffic is expected to access the CTF using either U.S. 20 or 26.

PBR validation test activities may require the closure of State Highways 33, 28, or 22 for durations of less than 1 hour. Traffic would be rerouted to the two open highways. This would add approximately 11 to 22 miles to traffic traversing INEL, depending on which highway was closed. Closure agreements would be negotiated with the State of Idaho Transportation Department. The arrangements for such closures at the INEL would be

prepared by the INEL security force in conjunction with the test facility operating contractor's security department.

Roads within INEL operate below capacity, and would be able to absorb traffic generated by the SNTP program.

4.4.2.2 Airspace. During test operations, the flaring of hydrogen would cause thermal heating to a height of several thousand feet. Currently, flights below 1,600 feet above ground level are restricted. The plume would stabilize at about 9,000 to 19,600 feet above ground level and could cause some heat or turbulence concerns to aircraft flying in it.

Mitigation Measures

Added traffic and road closures would not result in increased environmental impacts; therefore, mitigation measures would not be required.

In addition to the existing controls and notification procedures, special mitigation measures would likely need to be developed to restrict airspace during testing operations; avoidance of the plume (within approximately one mile of the flare stack) should be sufficient.

4.4.3 No-Action Alternative

If the SNTP program were not implemented, traffic in the vicinity of NTS or INEL would not increase as a result of program activities; neither would there be any need for changes to existing airspace restrictions. Conditions would be similar to the baseline conditions for transportation as described in Chapter 3.

4.5 HAZARDOUS MATERIALS AND HAZARDOUS WASTE MANAGEMENT

This section addresses the potential for environmental impacts caused by hazardous materials/waste management practices associated with the use of the SMTS and the CTF, and the potential impacts of existing contaminated sites.

Because SNTP operations at the selected PBR validation test facility would be the same at both alternative locations, the amounts and types of radioactive and non-radioactive hazardous wastes generated are expected to be the same at either location.

The proposed action involves transportation of fresh fuel material to one of the proposed testing locations; use of the fuel material to support research and development activities which result in irradiation of the fresh fuel material; and storage of the irradiated materials to ensure their availability for post-irradiation examination (PIE). The fuel components of these test

articles will be examined following irradiation and, in consideration of the negligible economic value of the irradiated material, they will eventually be disposed of as low level radioactive waste. Disposal would occur at either the installation selected to host the validation testing activities, or at the facility selected to perform PIE activities. When a test article is installed in its respective operating configuration, it represents a fully operational reactor system which does not require additional permanently installed fuel elements to support reactor operations. Consequently, long-term buildup of fission products normally associated with driver-type reactor fuel elements is precluded.

4.5.1 SMTS

If implemented at NTS, the SNTP Program Office would coordinate with NTS to minimize project wastes in compliance with the NTS Waste Minimization and Pollution Prevention Awareness Plan (DOE, 1991e).

4.5.1.1 Hazardous Materials. Transporting fresh non-irradiated nuclear fuel over the nation's roadways occurs utilizing Safe, Secure Transports or other approved packaging/vehicle systems that comply with Department of Energy (DOE), Department of Transportation (DOT), and Nuclear Regulatory Commission (NRC) safety and safeguards requirements (NRC, 1977). The transport vehicles are designed to provide sufficient safeguards to protect uranium-235 (U-235) while en route between secure facilities. Shipments are traced by an operations center located in Albuquerque, New Mexico, and escorted continuously whenever they are outside the boundaries of a secure facility.

The largest quantity of fuel material to be transported in a single shipment to support the PBR validation testing program is the inventory associated with one complete reactor core (an average of about 110 pounds per core). All proposed shipments, consisting entirely of fresh, non-irradiated uranium fuel, would be packaged in such a way as to result in negligible radiation exposures both at the surface of the transportation trailer and within the driver's compartment. Radiation surveys at the point of origin would be performed to demonstrate that spreadable contamination levels are negligible. A criticality analysis would be performed to assure compliance with DOT and NRC transport requirements. This ensures that no credible scenario could cause the material to be repositioned into a critical mass during normal transport or a hypothetical accident. All shipments would comply with the requirements of DOT regulations.

Transportation of irradiated test specimens for PIE is routine between test reactors and laboratories. Existing DOT-approved procedures would be used. All shipments within NTS of radioactive materials including U-235 would be accomplished in accordance with the specific requirements at NTS

and in compliance with DOE Orders. Arrangements would be made through the NTS Management and Operations contractor.

4.5.1.2 Nonradioactive Hazardous Waste. The quantity of nonradioactive hazardous waste anticipated to be generated during the PBR validation testing is estimated to be approximately 500 cubic feet (70 55-gallon drums) over the life of the program. A waste minimization program would be implemented to limit the generation of hazardous waste. Procedures would include product substitution when possible to reduce the quantity of solvents used in support of test activities. Hazardous wastes generated as a result of operations would be stored temporarily at the test facility. All waste would be labeled and shipped to an Environmental Protection Agency (EPA)-approved Treatment, Storage or Disposal Facility.

4.5.1.3 Radioactive Hazardous Waste. All radioactive waste materials generated during PBR validation testing would be managed in accordance with DOE Order 5820.2A (Radioactive Waste Management). Only low level waste (LLW) is expected to be generated by PBR validation testing; although mixed waste is not expected, analysis is provided in case small quantities are generated. TRU waste is not expected, but information is provided (see Section 3.5) to provide a complete evaluation of wastes.

Low-Level Waste (LLW)

It is anticipated that the LLW generated at the SMTS, including that associated with disposition of the irradiated fuel material, would be approximately 1.6 million cubic feet over the life of the project (5 percent generated during operations and 95 percent during decontamination and decommissioning). This total volume, which does not reflect any benefits from waste minimization efforts, includes an allowance of 50% for packaging material and voided spaces within the disposal containers. LLW requiring disposal would consist of solid wastes from handling, cleaning, and disassembling the fuel assemblies, contaminants removed directly from the effluent stream, components from the ETS, irradiated fuel material, and materials from decontaminating the facility at the end of the project. For analysis purposes, it was conservatively assumed that no LLW would be transported off the facility. These wastes would be appropriately packaged, nondestructively assayed, and disposed of at one of the existing Radioactive Waste Management Sites (RWMS) located on the Nevada Test Site.

NTS presently has a remaining capacity of 17.7 million cubic feet for solid low-level radioactive waste with an anticipated annual input of 880,000 cubic feet. SNTP LLW would require 9 percent of current capacity or 18 percent of projected available capacity at the end of the 10-year SNTP program. NTS is continually updating its solid LLW storage and disposal capacity requirements. Expansion of waste storage and disposal facilities is an ongoing process to meet the waste management mission of disposing of

all waste. The solid LLW generated as a result of the PBR validation testing would cause no changes in this operational arrangement.

Because approximately 95 percent of the LLW would be as a result of facility decontamination and decommissioning, only small quantities would be received at the NTS disposal site during PBR test operations. Virtually all would arrive following completion of PBR validation testing.

Mixed Waste

Mixed waste includes low-level radioactive materials contaminated by solvents or solvent residues. Although no mixed waste is anticipated, for purposes of conservative analysis up to 70 cubic feet of mixed waste (which could be contained in 10 55-gallon drums) annually has been considered.

Mixed wastes would be contained at their point of generation and characterized for eventual compliance with Land Disposal Restrictions (LDR) and the installation waste disposal requirements. Containers would be transported to the mixed waste RCRA (Resource Conservation and Recovery Act) disposal area at the RWMS (DOE, 1990f). Mixed wastes must meet LDR requirements prior to disposal.

NTS presently has a remaining capacity of 5 million cubic feet for mixed waste (DOE, 1990f) with an anticipated annual input of 700,000 cubic feet from approved DOE generators. The maximum anticipated annual input of mixed wastes from the SNTP program (70 cubic feet) is only 0.01 percent of the anticipated annual mixed waste input at NTS.

Transuranic (TRU) Waste

PBR validation testing activities would not generate TRU waste (see Section 3.5); however, NTS does maintain the capability to manage these materials.

4.5.1.4 Cumulative Effects. As discussed in Section 2.7, two of the three potential actions currently being studied by the DOE (environmental restoration and revised waste management procedures) could generate cumulative effects if implemented with the SNTP program at NTS. The consolidation of nuclear weapons facilities is not being considered for NTS, and therefore would not involve any cumulative effects with the SNTP program. The analysis presented below considers environmental restoration in combination with the SNTP program, then waste management in combination with the SNTP program, and then all three programs together.

As discussed in Section 2.7, some of the analyses are qualitative because the other programs are in early development phases, and only limited information is currently available.

Environmental Restoration. Details of hazardous materials/hazardous waste management aspects of environmental restoration are not sufficiently mature to perform quantitative analysis. NTS currently has identified a total of 779 potentially contaminated sites, all of which have been evaluated for type of waste/contamination, but none have been characterized for volumes of materials (DOE, 1992f).

The range of possible actions that may be implemented include the following:

- remove all contamination and dispose of it elsewhere
- remove contamination, treat the contamination to reduce contaminant levels, and then dispose of the residue elsewhere
- leave contamination in place, with technology controls to minimize migration of the contaminants
- combinations of removal, treatment, and control
- leave the situation as it is.

Of these options, only those actions involving removal of material and re-disposal is expected to cause cumulative impacts with the SNTP program. The re-disposal of these materials into existing disposal sites that would also be used to support the SNTP program would reduce the life of the disposal facility, and require accelerated development of additional disposal space. However, the basic capability of NTS to handle SNTP program wastes would still exist.

Waste Management. Revisions to DOE waste management policies and procedures, depending on the ultimate proposal implemented by the DOE (e.g., consolidation of Treatment, Storage or Disposal facilities at NTS for several other DOE facilities versus consolidation of portions of these activities at other facilities), could cause cumulative effects with SNTP at NTS for hazardous waste, low-level waste, and mixed waste.

Hazardous Waste. Because of the small quantities of hazardous waste generated by the SNTP program, cumulative effects with any waste management proposal are expected to be minimal.

Low-Level Waste (LLW). The maximum potential disposal of LLW at NTS would include 501,000 cubic feet per year from other DOE facilities,

existing LLW disposal rates from NTS itself (880,000 cubic feet per year), and LLW disposal from the SNTP program (1.6 million cubic feet over ten years). During the ten years of the SNTP program, these wastes could be accommodated by existing NTS LLW disposal capacity. However, these programs would hasten the need for additional disposal capacity to be developed to support other programs. DOE can develop additional LLW disposal capacity on NTS if required.

Mixed Waste. Revised waste management policies and procedures may include using NTS as a mixed waste disposal site. The SNTP program is not expected to generate any mixed waste. For analytical purposes, it is assumed that a maximum of 70 cubic feet per year will be generated. Some of this waste is likely to be treated to remove hazardous components; however, cumulative effects from any revised procedure are expected to be minimal.

Multiple Programs and SNTP

Proposals in which SNTP and two of the three other actions are implemented at NTS could also occur; these could change (either increase or decrease) the levels of impacts described above, depending on the specific combination of actions selected within environmental restoration and waste management.

The most likely area for additional impacts would be for LLW disposal. The disposal levels described above under waste management could be increased if environmental restoration options were selected that contained large amounts of removal and re-disposal of LLW. These situations could exhaust existing disposal capacity at a much higher rate, and require greatly accelerated development of new capacity. As stated previously, DOE does maintain the capability to develop additional capacity as required.

4.5.1.5 Mitigation Measures. Mitigation measures to reduce the impacts from PBR validation activities on the environment could include:

- Implementation of a minimization program to limit the generation of non-radioactive hazardous waste (e.g., solvents). Standard waste minimization measures in place at NTS for non-radiological wastes include product substitution (a primary method of source reduction of hazardous waste), recycling, reclamation, reuse, inventory management, changes in operating practices, implementation of corrective and preventive maintenance, segregation of waste types, process equipment modification (to eliminate the need for specific hazardous materials that may generate wastes), and employee training, awareness programs, and incentive programs (DOE, 1991e).

- Adherence to the in-place volume reduction program to reduce the amount of solid LLW. A major source of potential waste reduction for LLW is radiation monitoring programs, in which intensive surveying of materials (especially during decontamination and decommissioning) can be used to segregate radioactive from non-radioactive waste. This waste segregation measure can significantly reduce the amount of materials classified as LLW, thus reducing the 1.6 million cubic feet of LLW analyzed above (DOE, 1991e).

- Implement measures to reduce the amount of void space (e.g., bulk disposal, rather than packaged in 55-gallon drums) in waste disposal practices.

- Increasing the LLW storage and disposal capacity.

4.5.2 CTF

As with NTS, the SNTP program office would coordinate with INEL to minimize project wastes in compliance with INEL waste minimization goals (DOE, 1992b; 1992d).

4.5.2.1 Hazardous Materials. The impacts associated with transporting U-235 for PBR validation testing at the CTF are identical to those described for the SMTS, except that coordination would be through INEL, rather than NTS (*see Section* 4.5.1.1).

4.5.2.2 Nonradioactive Hazardous Waste. The quantity of nonradioactive waste generated at the CTF would be the same as for the SMTS. Similar management procedures would be followed, including implementation of a waste minimization program and final disposition to an EPA-approved Treatment, Storage or Disposal Facility (see Section 4.5.1.2).

4.5.2.3 Radioactive Hazardous Waste. All radioactive waste materials generated during PBR validation testing activities will be managed in accordance with DOE Order 5820.2A (Radioactive Waste Management). Only LLW is expected to be generated by PBR validation testing; although mixed waste is not expected, analysis is provided in case small quantities are generated. TRU waste is not expected, but information is provided (see Section 3.5) to provide a complete evaluation of wastes.

Low-Level Waste (LLW)

A performance goal at INEL for LLW disposal is to restrict disposal of all LLW with TRU content greater than 10 but less than 100 nanocuries per gram; as a result, all LLW in this category is stored at an existing storage area at the RWMC. The only SNTP LLW expected to fall in this range of TRU content is the fuel in the used reactor cores. Of the 1.6 million cubic

feet of LLW to be generated by the SNTP program, much less than one percent would require storage instead of disposal. The amount of LLW requiring storage would be approximately 450 kilograms (990 pounds) if fuel is removed from the cores or 1,000 kilograms (2,200 pounds) if the fuel and cores are kept intact. If kept intact, each of the 10 PIPET cores and 10 GTA cores would have a volume of about 2.8 cubic feet. When packaged for storage/disposal, the volume of this LLW could range from 10 to 560 cubic feet, depending on whether the fuel is removed from the cores, and depending on specific packaging that would be used. INEL has sufficient storage capacity for even the maximum volume of LLW at the RWMC. The remainder of the SNTP-generated LLW would have TRU content less than 10 nanocuries per gram, and would be disposed of at the RWMC (see below).

Final disposition of LLW with higher TRU content is pending ongoing DOE studies to revise waste management practices (Section 2.7). Once these revised practices have been established, this LLW would be disposed of in one of several manners. Some options for disposal include:

- Transportation to another DOE facility that can dispose of this LLW

- Opening a new disposal site on INEL that can accept and dispose of LLW with TRU concentration between 10 and 100 nanocuries per gram

- Revising disposal procedures at the existing disposal site to accept this LLW for disposal.

Under any of these options, sufficient disposal capacity for these small quantities of LLW could be provided.

INEL presently has a remaining capacity of 3.5 million cubic feet for low-level radioactive solid waste with an annual input of 102,000 cubic feet. Assuming the same 50% factor for voided spaces and packaging materials, the 1.6 million cubic feet generated over the life of the SNTP program would require 46 percent of INEL's current capacity, or 65 percent of projected available capacity at the end of the 10-year SNTP program. DOE can develop additional LLW disposal capacity on INEL if required.

Because approximately 95 percent of the LLW would be as a result of facility decontamination and decommissioning, only small quantities would be received at the INEL disposal site during PBR test operations. Virtually all of the LLW would arrive following completion of PBR validation testing.

Mixed Waste

Although no mixed waste is anticipated, for purposes of conservative analysis up to 70 cubic feet of mixed waste (which could be contained in 10 55-gallon drums) annually has been considered.

INEL presently has a baseline capacity of 2,280 cubic feet for mixed radioactive waste in interim storage. The anticipated annual throughput of mixed wastes from PBR validation testing (70 cubic feet) represents a 2.2 percent increase in the annual throughput of mixed waste at INEL. Mixed wastes are presently stored on site at INEL, pursuant to a mixed waste compliance plan. In addition, this compliance plan contemplates storage of mixed waste only until permanent treatment or disposal is available at an EPA-approved facility. One option INEL is considering is developing on-site disposal capacity, through incineration. If this is not available, the material will be shipped to an EPA-approved Treatment, Storage or Disposal Facility.

Transuranic (TRU) Waste

PBR validation testing activities would not generate TRU waste (see Section 3.5); however, the INEL does maintain the capability to manage these materials.

4.5.2.4 Cumulative Effects. As discussed in Section 2.7, all three potential actions currently being studied by the DOE (environmental restoration, revised waste management procedures, and reconfiguration of the nuclear weapons production complex) could generate cumulative effects if implemented with the SNTP program at INEL. The analysis presented below considers environmental restoration in combination with the SNTP program, then waste management in combination with the SNTP program, then reconfiguration in combination with the SNTP program, and then combinations of all four programs together.

As is discussed in Section 2.7, some of the analyses are qualitative because the other programs are in early development phases, and only limited information is currently available.

Environmental Restoration. Details of hazardous materials/hazardous waste management aspects of environmental restoration are not sufficiently mature to perform quantitative analysis. INEL currently has identified a total of 485 potentially contaminated sites, most of which have been evaluated for type of waste/contamination, but only a few have been characterized for volumes of materials (DOE, 1992f).

The range of possible actions that may be implemented include the following:

- remove all contamination and dispose of it elsewhere
- remove contamination, treat the contamination to reduce contaminant levels, and then dispose of the residue elsewhere
- leave contamination in place, with technology controls to minimize migration of the contaminants
- combinations of removal, treatment, and control
- leave the situation as it is.

Of these options, only those actions involving removal of material and re-disposal are expected to cause cumulative impacts with the SNTP program. The re-disposal of these materials into existing disposal sites that would also be used to support the SNTP program would reduce the life of the disposal facility, and require accelerated development of additional disposal space. As is discussed in Section 4.5.2.3, the SNTP program would require up to 46 percent of the existing LLW disposal volume at INEL. However, the basic capability of INEL to handle SNTP program wastes would still exist.

Waste Management. Revisions to DOE waste management policies and procedures, depending on the ultimate proposal implemented by the DOE (e.g., consolidation of Treatment, Storage or Disposal Facilities at INEL for several other DOE facilities versus consolidation of portions of these activities at other facilities), could cause cumulative effects with SNTP at INEL for hazardous waste, LLW, and mixed waste.

Hazardous Waste. Because of the small quantities of hazardous waste generated by the SNTP program, cumulative effects with any waste management proposal are expected to be minimal.

Low-Level Waste (LLW). The only LLW consolidation action being considered that would occur at INEL is the continued disposal of LLW generated by INEL in its facilities. Because this proposal is the same as the baseline conditions described in Section 4.5.2.3, any LLW action would not cause additional impacts above those already described.

Mixed Waste. Revised waste management policies and procedures may include using INEL as a comprehensive treatment and disposal site. The SNTP program is not expected to generate any mixed waste. For analytical purposes, it is assumed that a maximum of 70 cubic feet per year will be generated. Some of this waste is likely to be treated to remove hazardous components; however, cumulative effects from any revised procedure are expected to be minimal.

Reconfiguration of Nuclear Weapons Complex. As discussed in Section 2.7, the waste from a possible consolidation of nuclear weapons production facilities to INEL could cause additional impacts (DOE, 1992f). Although the wastes from a nuclear weapons production program at INEL have not yet been defined, maximum limits can be estimated from wastes at other facilities from which the program would move: the Savannah River Site (South Carolina), Oak Ridge Y-12 (Tennessee), Rocky Flats Plant (Colorado), and the Pantax Plant (Texas). Calculations in this analysis assumed that all of the annual waste generated from these facilities would be transferred with the reconfiguration, and 1991 waste generation rates would remain stable. Because of possible future reductions in nuclear weapons production, and because of expected waste reduction procedures, this analysis calculates maximum possible cumulative impacts.

Hazardous Waste. Because of the small quantities of hazardous waste expected from the SNTP program, cumulative effects with the reconfiguration actions would be minimal.

Low-Level Waste (LLW). If all of the facilities were to move to INEL, INEL could experience as much as an additional 1.1 million cubic feet of LLW per year. As with SNTP LLW, some of the LLW could not be disposed of at INEL, due to the disposal restrictions on TRU content in LLW. The same storage/disposal issues discussed for the SNTP program would apply for the reconfiguration action.

Because of the large amount of LLW that could be transferred to INEL as part of the reconfiguration, this program, in combination with SNTP, could accelerate need for additional storage space much sooner than otherwise.

Mixed Waste. The SNTP program is not expected to generate any mixed waste. For analytical purposes, it is assumed a maximum of 70 cubic feet per year will be generated. Some of this waste is likely to be treated to remove hazardous components; however, cumulative effects from any revised procedure are expected to be minimal.

Multiple Programs and SNTP

Proposals in which SNTP and all three of the other actions are implemented at INEL could also occur; these could change (either increase or decrease) the levels of impacts described above, depending on the specific combination of actions selected within environmental restoration and waste management. Because of the large number of possible combinations of proposals that could be implemented, only a conceptual discussion of the types of changes to cumulative impacts is discussed.

The most likely area for additional impacts would be for LLW disposal. The disposal levels described above under waste management could be

increased if environmental restoration options were selected that contained large amounts of removal and re-disposal of LLW. These situations could result in the exhaustion of existing disposal capacity at a much higher rate, and require greatly accelerated development of new capacity. As stated previously, DOE does maintain the capability to develop additional capacity as required.

Some potential combinations of programs at INEL could hasten waste disposal issues (e.g., increased LLW generation rates from environmental restoration activities, reconfiguration activities, SNTP, and other ongoing INEL programs). Other combinations of programs would have no additional effect (e.g., because no waste management proposals for INEL would increase LLW generation rates at INEL, waste management would not cause other disposal issues). Still other proposals may reduce the amount of cumulative impacts described above (e.g., implementation of the reconfiguration program at INEL, and a waste management consolidation alternative at another DOE facility, would reduce total LLW disposal at INEL and reduce or eliminate the INEL issue of disposal of LLW with TRU content greater than 10 nanocuries per gram).

SNTP activities would not impact the ongoing groundwater cleanup at TAN or any other environmental restoration programs at INEL. Groundwater pumping for SNTP needs would not substantially change the water table levels over the long term; short-term pumping would only change the water table in the immediate vicinity of the well. Therefore, the SNTP water requirements would not change groundwater flow of contaminated water being cleaned at TAN.

4.5.2.5 Mitigation Measures. Mitigation measures to reduce the impact from SNTP hazardous materials/waste would be the same as for the SMTS, as identified in Section 4.5.1.5. Waste minimization measures for INEL are discussed in DOE, 1992b and 1992c.

4.5.3 No-Action Alternative

Because no new construction, facility modification, hazardous material use, or hazardous waste generation activities would occur with the No-Action Alternative, no impacts to the environment would occur at either of the SNTP alternative sites.

4.6 AIR QUALITY

Construction and operation of the proposed field test facility, regardless of the selected location, would produce small amounts of air pollution from the combustion of fossil fuels from mobile sources and for power generation. Fugitive dust emissions would be expected during construction and earth-moving activities.

Airborne releases of radioactive materials are regulated by the National Emissions Standards for Hazardous Air Pollutants (NESHAP). The impacts of potential airborne releases associated with the proposed action are discussed in Section 4.12.

4.6.1 SMTS

At the SMTS, it would be necessary to perform several activities during the construction phase of the project that could potentially impact air quality. Fugitive dust (particulate matter less than 10 microns in diameter [PM_{10}]) emissions would be generated from the 100 acres of land cleared for PBR validation testing. In addition, 2 acres would be cleared for associated infrastructure (water and power) support and from errant vehicles crossing into previously undisturbed areas. PM_{10} emissions are a function of the amount of land cleared, the time of exposure, soil type and moisture, and windspeed. Elevated PM_{10} concentrations would tend to fall off rapidly from the source with distance. Left uncontrolled, dust and the associated PM_{10} emissions would continue to blow off of graded surfaces indefinitely. Approximately 4 acres of land surrounding the facility fence (used for a fire break) would be a long term source of PM_{10}, if not mitigated. Additional emissions anticipated from construction include exhausts from vehicles and equipment used during site development. Exhaust emissions associated with construction amount to a very minor, short term component of the regional air pollutant inventory. NTS has an active air quality permit (OP1585) that would allow emissions from SNTP program ground disturbance/construction activities.

Emissions from the operational phase of the project would be related to vehicle traffic (including commuter traffic) and minor site activities, including the intermittent use of diesel power generators and sources which contribute to the volatile organic compound emission inventory. If portable generators larger than 500 brake-horsepower are required for this activity, air emission permits, issued by the state of Nevada, would be required prior to their use. Stationary generators (i.e., in place longer than 1 year) larger than 250 brake-horsepower require Nevada air emission permits. Generally, the combustion products from hydrogen flaring are not regulated chemicals. There is some generation of NO_x in the combustion process. Using very conservative estimates, several models were run to identify NO_x levels. Based on these studies, the peak ground level air concentrations were 300 micrograms per cubic meter for stability class C (Section 4.12), and 23 micrograms per cubic meter for stability class D. Average concentrations would be much lower than these peak values; use of less conservative assumptions would lower these values further (Sherman, 1993; Carney, 1993).

The federal primary standard for NO_2 is 100 micrograms per cubic meter for annual average concentration, and 1,130 micrograms per cubic meter for

1-hour average concentration. Based on the model results listed above, and because of the relative infrequency of the tests, the NO_x concentrations from PBR validation tests are expected to be much lower than the standards. After flaring, the primary components (over 98 percent) are nitrogen, water vapor, oxygen, and hydrogen. Because tests would be infrequent and of short duration, and because these flare stack emissions are components of air that are not regulated by air quality laws or regulations, PBR testing emissions are not expected to affect the air quality of the region.

Very small quantities of CO, NO_2, and PM_{10} may be generated if a natural gas pilot system is used for the hydrogen flare. These emissions are not expected to add substantially to the regional air pollution inventory; however, applicable permits may be required. Other ignition systems (e.g., electric glow plugs) can eliminate these emissions.

Because the dispersion of atmospheric components at NTS is good, and the amount of pollutant emissions associated with this alternative are minor, the impact on the regional and local air quality from this alternative would be negligible.

4.6.1.1 Mitigation Measures. Although the impacts from construction activities (land clearing and associated vehicle and equipment emissions) would be slight, the following mitigation measures would further reduce the potential for dust and exhaust emissions at the site:

- Minimize the length of time fresh soil surfaces are left exposed
- Periodically spray exposed surfaces with water or a soil binder
- Minimize the extent of ground disturbance to that necessary to accomplish the project
- Delay ground disturbance activities during periods of high winds
- Perform revegetation and/or restabilization of disturbed areas upon completion of construction activities. This may include paving or graveling of exposed soils
- Maintain exhaust systems on construction equipment and vehicles at the proper operating levels
- Use of unleaded and/or other emission-reducing fuels in project vehicles
- Use of glow plugs or other non-emitting ignition systems for hydrogen flaring.

Operational emissions could be reduced by encouraging the use of carpools and buses to the site by commuting employees. While on the site proper, employees could be encouraged to walk or use bicycles for transportation. Additional mitigation would include the maintenance of equipment (i.e., generators, tanks) in order to minimize emissions from these sources.

4.6.2 CTF

At the CTF, it would be necessary to perform several activities during the construction phase of the project that could potentially impact air quality. Fugitive dust (PM_{10}) emissions would be generated from the 55 acres of land cleared for PBR validation testing. PM_{10} emissions are a function of the amount of land cleared, the time of exposure, soil type and moisture, and windspeed. Elevated PM_{10} concentrations would tend to fall off rapidly from the source with distance. Left uncontrolled, dust and the associated PM_{10} emissions would continue to blow off of graded surfaces indefinitely. Additional emissions anticipated from construction include exhausts from vehicles and equipment used during site development. Exhaust emissions associated with construction amount to a very minor, short-term component of the regional air pollutant inventory.

Emissions from the operational phase of the project would be related to vehicle traffic (including commuter traffic) and minor site activities (including volatile organic compound emissions from various sources). If portable generators are to be used for this activity, air emission permits may be required from the state of Idaho, depending on the type and size of generators. The flare stack associated with the operational phase is not anticipated to produce any measurable emissions. After flaring, the primary components (over 98 percent) are nitrogen, water vapor, oxygen, and hydrogen, all of which are components of air that are not regulated by air quality laws or regulations. Test operations would be infrequent and of short duration, and are not expected to affect the air quality of the region.

As with operations at the SMTS, the ignition system for the hydrogen flare could be a minor emission source, if natural gas is used. Applicable permits may be required. Use of other types of ignition systems can reduce or eliminate these emissions.

Because the dispersion of atmospheric components at INEL is good, and the amount of pollutant emissions associated with this alternative is minor, the impact on the regional and local air quality from this alternative would be negligible.

4.6.2.1 Mitigation Measures. Although the impacts from construction activities (land clearing and associated vehicle and equipment emissions) are slight, the mitigation measures discussed in Section 4.6.1.1 would further reduce the potential for dust and exhaust emissions at the site.

Operational emissions may be reduced by encouraging the use of carpools and buses to the site by commuting employees. While on the site proper, employees could be encouraged to walk or use bicycles for transportation. Additional mitigation includes the maintenance of equipment (i.e., storage vessels) in order to minimize emissions from these sources.

4.6.3 No-Action Alternative

Because no construction or PBR validation test operations would occur with the No-Action Alternative, no impacts to air quality would occur.

4.7 BIOLOGICAL RESOURCES

Implementation of the Proposed Action at the two alternative sites could potentially affect biological resources through alteration or loss of vegetation and wildlife habitat. These impacts are described below for each alternative.

4.7.1 SMTS

Construction of PBR validation test facilities at the SMTS would affect biological resources primarily through the loss of vegetation and wildlife habitat. Noise during operation of the facility would temporarily frighten off some wildlife species, and thermal heating from the flaring of hydrogen gas might kill birds flying nearby.

4.7.1.1 Vegetation. The construction of the validation test facility would result in the loss of approximately 100 acres of land from the Transitional Desert Association habitat. This vegetation community is common, and no sensitive, threatened, or endangered species are found at the site. An area of 4 acres surrounding the test facility fence would have all vegetation removed to act as a fire break. Brush fires are a major risk to programs at NTS and have accounted for plant cover modification of sizeable areas.

Construction of the test facility, potential improvement of the access road, and installation of the required electrical transmission line and water system would impact up to 1,000 Joshua trees. Joshua trees are not listed as threatened or endangered by either the state or federal governments and do not require mitigation measures for their removal.

The heat generated by the flare stack (and possibly other operations) may cause some fire hazard for weedy and fire-prone plant species near SNTP facilities. Section 4.7.1.5 lists mitigation measures that could minimize this potential.

4.7.1.2 Wildlife. Noise from the validation tests are expected to reach approximately 125 adjusted decibels (dBA) (see Figure 3.10-1) and would

affect the nearby animal populations, principally birds commonly found in the area, such as the black-throated sparrow and Le Conte's thrasher. Birds would be frightened off temporarily at the beginning of testing activities, but are expected to return upon completion of each test. Other animals, such as rodents and other small mammals and reptiles, may also be frightened off by the test noise.

The flaring of hydrogen from the effluent treatment system would cause thermal heating of approximately 810 Kelvin (K) (540° Centigrade [C]) to a height of several hundred feet. In addition, the flame from hydrogen is not visible during the daytime unless treated with a chemical to provide color. The flare during those tests would kill any birds flying into it or perching on the stack; however, noise from the flaring may serve to scare away birds that might otherwise perch on or fly over the flare stack.

4.7.1.3 Threatened and Endangered Species. Based on existing data and the survey of the SMTS and its new power line route, no federally listed threatened or endangered species, or their habitat, are known to occur at the SMTS.

Increased road traffic and maintenance activities on Saddle Mountain Road could potentially impact the desert tortoise as this road partially traverses desert tortoise habitat. Existing documentation and mitigations for these types of activities would apply regardless of whether PBR validation testing is implemented at NTS (EG&G, 1991; DOE, 1991c; U.S. Fish and Wildlife Service, 1992a). However, these impacts would be minimized by implementing the mitigation measures discussed in Section 4.7.1.5. If the Northern Route (Mercury Highway to Mine Mountain Road) is used, there would be no impacts to the desert tortoise because neither road traverses desert tortoise habitat.

4.7.1.4 Sensitive Habitats. The only known sensitive habitat in the vicinity of the SMTS is a potential wetland, Yucca Flats (Dry) Lake, located eight miles east of the SMTS. Construction and operational activities at the SMTS would be localized to the Saddle Mountain area and would not impact this potential wetland.

4.7.1.5 Mitigation Measures. Because the desert tortoise is a federally listed threatened species, mitigation measures are required to reduce or eliminate negative impacts to the species. Road maintenance and traffic, such as would occur from SNTP, is included in a Biological Assessment for normal activities at NTS (DOE, 1991f). Mitigations listed in the U.S. Fish and Wildlife Service's Biological Opinion on Nevada Test Site Activities, May 1992, are in place at NTS and would be implemented to minimize the mortality or injury of desert tortoises due to road maintenance or vehicle 1992a traffic (U.S. Fish and Wildlife Service, 1992a). No mitigations would

be necessary for vehicle traffic or road maintenance on the Northern Route as the desert tortoise would not be impacted along these roadways.

Mitigation measures to reduce fire potential could include installing gravel pads under new facilities and an active weed prevention program in these areas. Lands temporarily disturbed during construction could be revegetated with native plant species.

4.7.2 CTF

Construction of PBR validation test facilities at the CTF would result in only minor impacts to biological resources because of the developed nature of TAN.

4.7.2.1 Vegetation. Because of the existing developed nature of TAN in general and the CTF site in particular, modifications to existing facilities and construction of the test facility would affect less than 50 acres of previously disturbed land adjacent to the containment structure. The highly disturbed nature of the land in the vicinity has resulted in low quality habitat.

The heat generated by the flare stack (and possibly other operations) may cause some fire hazard for weedy and fire-prone plant species near the SNTP facilities. Section 4.7.2.5 lists mitigations to minimize this potential.

4.7.2.2 Wildlife. The same activities that impact wildlife during operations at NTS would also occur at the CTF. Birds and other small animals would be frightened away temporarily due to noise from the validation test facility. Birds flying into the flare or perching on the stack would be killed; however, this is expected to happen only rarely. Wildlife, principally birds, small mammals, and rodents, could be affected by the noise levels described for construction and testing activities; however, these noise levels would be temporary and wildlife would be expected to return as they subside. The roar of the flare could provide a beneficial impact by scaring animals away and preventing their exposure to the emissions and heat from the flare stack. Due to previous disturbances to vegetation, the existing developed nature and activities of the facility, the noise of the flare that would help prevent direct impacts to wildlife from the flare, and the limited wildlife habitat present, impacts associated with construction of the facility and with test operations would be less than for newly constructed sites.

4.7.2.3 Threatened and Endangered Species. The bald eagle has been observed in the past in the northern portions of INEL, with several individuals roosting at Little Lost River approximately 12 miles west of the CTF and foraging near the mountains north and west of INEL. If transient bald eagles or other candidate raptors perch on the stack or fly over the flare, they would be killed. However, the chance of an eagle being close enough to the flare stack when flaring initiates is low, and eagle-mortality

incidences during the rest of the test are not expected because the roar of the flare would scare eagles away. Therefore, no impacts that would jeopardize the continued existence of these species are expected if PBR validation test facilities are located at the CTF.

4.7.2.4 **Sensitive Habitats.** Because there are no sensitive habitats in the immediate vicinity of the CTF and any potential wetlands are upstream of the CTF, the construction and operation of the facility would have no impacts on sensitive habitats.

4.7.2.5 **Mitigation Measures.** Because no impacts to sensitive habitats or to threatened or endangered species would occur, no mitigation measures are required for their protection. However, sirens or other deterrents could be used prior to flaring to frighten away any sensitive raptors that might be perching on the stack or flying in the vicinity. Other mitigation measures to reduce fire potential could include installing gravel pads under new facilities and active weed prevention program in these gravel areas. Lands temporarily disturbed during construction could be revegetated with native species.

4.7.3 No-Action Alternative

Because no construction, facility modification, or test operations would occur with the No-Action Alternative, no impacts to biological resources would occur at either of the SNTP alternative sites.

4.8 CULTURAL RESOURCES

Potential impacts to cultural resources were assessed by (1) identifying the type and location of activity that could directly or indirectly affect cultural resources, (2) determining the nature and potential significance of cultural resources in potentially affected areas, and (3) classifying potential effects as adverse or not adverse.

As outlined by the regulations implementing Section 106 of the National Historic Preservation Act (36 Code of Federal Regulations [CFR] Part 800.9) program activities can have an adverse effect on a historic property when that effect may alter the characteristics that qualify it for inclusion in the National Register. Adverse effects include but are not limited to:

- Physical destruction, damage, or alteration of all or part of the property
- Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register of Historic Places (National Register)

- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting

- Neglect of a property resulting in its deterioration or destruction

- Transfer, lease, or sale of the property.

Effects that would otherwise be found to be adverse may be considered as being not adverse for the purpose of Section 106 when:

- The historic property is of value only for its potential contribution to archaeological, historical, or architectural research, and when such value can be substantially preserved through the conduct of appropriate research, and such research is conducted in accordance with applicable professional standards and guidelines

- The undertaking is limited to the rehabilitation of buildings and structures and is conducted in a manner that preserves the historical and architectural value of affected historic property through conformance with the Secretary's "Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings"

- The undertaking is limited to the transfer, lease, or sale of a historic property, and adequate restrictions or conditions are included to ensure preservation of the property's significant historic features.

4.8.1 SMTS

4.8.1.1 Archaeological Resources. During the cultural resources surveys at the SMTS, seven prehistoric archaeological sites were identified within the region of influence at the SMTS (see site descriptions in Section 3.8.1). Five of the sites were collected and the remaining two sites are isolated finds; none of the sites are considered significant under National Register criteria and State Historic Preservation Officer (SHPO) concurrence has been received (Appendix G). Because of these findings, no adverse impacts are expected to occur to archaeological resources if the SMTS alternative is chosen for SNTP activities.

4.8.1.2 Historic Resources and Structures. Because no historic resources or structures have been identified within the region of influence for activities at the SMTS, no impacts are expected to occur.

4.8.1.3 Native American Resources. Because no Native American resources have been identified within the region of influence for the SMTS site, no impacts are expected to occur.

4.8.1.4 Paleontological Resources. Because no paleontological resources have been identified within the region of influence for the SMTS site, no impacts are expected to occur.

4.8.1.5 Mitigation Measures. Although the known archaeological resources located within the SMTS region of influence are not considered significant, the presence of sites does indicate some potential for cultural resources to be discovered during the course of project activities. In the event that archaeological, historic, paleontological, or Native American resources are discovered, ground disturbing activities would cease in the immediate area and a qualified archaeologist would be notified; all subsequent actions would comply with 36 CFR 800.11 and the Native American Graves Protection and Repatriation Act.

To ensure that traditional cultural properties, burials, and sacred sites or objects are identified during excavations and given proper treatment, Native Americans representing the 17 tribal groups of the Nevada Test Site American Indian Religious Freedom Act Compliance Program often participate in archaeological activities at NTS. As appropriate, Native American groups would be contacted during SNTP activities.

4.8.2 CTF

4.8.2.1 Archaeological Resources. Three prehistoric archaeological sites (one sparse lithic scatter and two isolated activity areas) have the potential to be affected by SNTP activities at the CTF site. None of these sites is considered significant under National Register criteria and all surveys of the CTF and TAN area indicate a low probability for encountering additional cultural resources (Idaho State University, 1986; EG&G Idaho, Inc., 1992). Consultation with INEL's cultural resources contractor confirmed that no further archaeological surveys would be required for SNTP activities at the CTF site, and the Idaho SHPO has concurred (Appendix G). Because of these findings, no adverse impacts are expected to occur to archaeological resources if the CTF alternative is chosen for SNTP activities.

4.8.2.2 Historic Resources and Structures. Historically, many INEL facilities have been considered unique because of the nature of the activities associated with them. As described in Section 3.8.2, the CTF is the only nuclear reactor test facility of its size in the world designed to simulate all of the important events that could occur in a commercial pressurized water reactor power plant. The Idaho SHPO has concurred that although the reactor has been removed and the building is currently undergoing asbestos abatement, the CTF continues to retain qualities that make it eligible for nomination to the National Register (Appendix G). Consultation is currently in progress among the SHPO, the Advisory Council on Historic Preservation, and the DOE Idaho Field Office. A Memorandum of Agreement to outline

various mitigation requirements for SNTP use of the CTF has been drafted (Section 4.8.2.5).

4.8.2.3 Native American Resources. Because no Native American resources have been identified within the region of influence for the CTF alternative, no adverse impacts are expected to occur.

4.8.2.4 Paleontological Resources. Because no paleontological resources have been identified within the region of influence for the CTF alternative, no adverse impacts are expected to occur.

4.8.2.5 Mitigation Measures. Although the known archaeological resources located within the CTF region of influence are not considered significant and the probability for additional sites is low, the presence of sites does indicate some potential for cultural resources to be discovered during the course of project activities. In the event that archaeological, paleontological, or Native American resources are discovered, ground-disturbing activities would cease in the immediate area and a qualified archaeologist would be notified; all subsequent actions would comply with 36 CFR 800.11 and the Native American Graves Protection and Repatriation Act.

To ensure that traditional cultural properties, burials, and sacred sites or objects are identified during excavations and given proper treatment, Native American monitors representing the Shoshone-Bannock tribe have participated in archaeological activities at INEL; a Working Agreement relating to cultural resources monitoring exists between the tribe and the Department of Energy (U.S. Department of Energy and the Shoshone-Bannock Tribes, 1992). As appropriate, a Native American monitor would be contacted during SNTP activities.

The consultation process, identified in Section 4.8.2.2, has proposed mitigative measures to minimize impacts to the CTF while accommodating its use for SNTP activities; such measures will ensure that the historic significance of the CTF is documented. A draft Memorandum of Agreement has been developed which provides for the development of a historic report, a Historic Preservation Plan, and interim protection for the CTF facility (Appendix G). Specific measures to support these activities could include compiling and archiving engineering drawings, photographic documentation, and narrative documentation.

4.8.3 No-Action Alternative

Because no ground-disturbing activities or facility modifications would occur with the No-Action Alternative, no impacts to cultural resources would occur at either of the two SNTP alternative sites.

4.9 GEOLOGY AND SOILS

4.9.1 SMTS

4.9.1.1 Physiography and Geology. Construction of the PBR validation test facility would require no more than 100 acres of land; grading and site preparation (cut and fill) requirements are approximately 26,000 and 37,000 cubic yards, respectively. Fill material would be extracted from a borrow area on the NTS and the excavated material from road construction would be deposited on the downhill side or utilized for fill within the test facility.

Alterations to the natural drainage could occur as a result of grading. Culverts would be designed into the surface drainage system for ramps and road crossings. Runoff from heavy precipitation may fill adjacent dry washes, but would not flood the facility because of its location on a interchannel topographic high, and other construction designs to prevent flooding of operations areas. Because the SMTS would be built to be compatible with existing topographic contours and facility size would be minimized where possible, little change would be made to the natural terrain.

4.9.1.2 Seismic and Volcanic Activity. The SMTS would have a potential for moderate damage from seismic activity. The SMTS area is also exposed to some ground motion and shock waves from underground testing of nuclear explosions. As a safety precaution, and due to the ground motion from underground testing, structures in the forward area (including the SMTS) at NTS are required to conform to UBC Seismic Zone 4 (greatest seismic risk zone) construction criteria and these requirements would be incorporated into facility and infrastructure designs for the SMTS. Appropriate DOE design criteria for the reactor facilities would also be implemented. Because of this design requirement, no impacts are expected.

In the event of a significant earthquake, the primary concern would be strong ground motion during a PBR validation test activity, causing an accident. Because of the relatively few number of PBR validation tests, the infrequency of large earthquakes nearby, and the relatively short duration of both, simultaneous occurrence of both events is unlikely. Credible accident scenarios are analyzed in Section 4.12 and Appendix E. Reactor accidents from underground testing could be minimized by scheduling events so that PBR validation tests and underground tests are not simultaneous.

Studies have shown that the underground testing has not caused widespread decreases in rock strength, which could have indirect effects on facility construction. A given underground nuclear explosion only affects rock strength to a distance of about three radii of the test cavity (Office of Technology Assessment, 1989). Underground testing would not make the

subsurface at the SMTS "unstable" and, therefore, no impacts are projected.

Because no volcanic eruptions have been reported during historic times, the potential for impacts to SNTP activities over the 10-year life of the program from volcanic activity would be remote. Current studies being conducted in Crater Flat, approximately 21 miles southwest of the SMTS, on eruptions from existing cinder cones indicate the last eruptions occurred approximately 10,000 to 20,000 years ago.

4.9.1.3 **Soils.** Construction activities at the SMTS would involve leveling and/or resurfacing of soils on approximately 100 acres. Although dust and soil would be transported by wind during these activities, effects are expected to be local and temporary. Removal of vegetation from the construction area would not significantly increase soil erosion because the area is sparsely vegetated and the ground surface is predominantly gravel. Therefore, wind effects and increases in soil erosion from rainfall are expected to be minimal. Protection against erosion would include:

- Orientation of the facility parallel to natural surface features to minimize water-induced erosion
- Orientation of the facility to minimize wind-induced erosion
- Application of water to minimize wind-induced erosion
- Revegetation of temporarily disturbed locations.

4.9.1.4 **Mitigation Measures.** Because measures to reduce the level of impacts to geology and soils such as those listed above would be incorporated into the design and program plans for the Proposed Action at the SMTS, no mitigation measures would be required.

4.9.2 CTF

4.9.2.1 **Physiography and Geology.** The expansion of the CTF facility would require the excavation of about 11,000 cubic yards. Some alterations of the natural drainage could also occur as a result of grading. Because little change would be made to the character of the area, the modification of the CTF would have a negligible impact on topography. The site does have some potential for flooding. Based on available data (Section 3.9.2.1), this study assumes that the existing facilities at the CTF (elevation about 4,790 feet MSL) are located several feet above the floodplain level. Although the areas adjacent to the CTF that would be used for new facilities may be at or above the 100-year floodplain elevation, this study assumes that they would be within the 100-year floodplain. In accordance with Executive Order 11988, new facilities and infrastructure would be designed

and constructed to ensure that they are elevated (or that the ground level is raised, if necessary) to about the same elevation as the existing facilities, and that engineering controls would be used to minimize flooding at these new facilities.

Because the proposed modification and operation of the test facility at the CTF would cause no loss or irretrievable commitment of geological resources, the project would have a negligible impact on geology.

4.9.2.2 Seismic and Volcanic Activity. Based on the potential for seismic activity in the area, the possibility of an earthquake of magnitude 7.5 in the vicinity of INEL has been suggested. Larger earthquakes have not been recorded in this area, but could occur based on the geotectonic setting of the area. The existing structures, and those that would be constructed at the CTF in support of the Proposed Action, would conform to all applicable seismic construction requirements. The primary concern from a significant earthquake would be strong ground motion during a test activity, causing an accident; however, simultaneous occurrence of both events is unlikely. Credible accident scenarios arising from an earthquake are analyzed in Section 4.12 and Appendix E.

Two major stages of volcanic activity (explosive and non-explosive) have occurred in the Eastern Snake River Plain over the past 15 million years. Non-explosive volcanism began about four million years ago and continued to as recently as 2,000 years ago, producing a series of overlapping basaltic flows from numerous local vents and small craters. Although there are two inactive volcanic craters within 6 miles of the CTF site, and over time the INEL area has been volcanically active, there have been no eruptions or flows for over 2,000 years. Because probabilities of volcanic hazards are low (Section 3.9.2.3), impacts related to volcanic activity are not expected.

4.9.2.3 Soils. Construction would cause some leveling or resurfacing of the soils on less than 50 acres. Dust and soil would be transported by winds during construction activities, but the effect would be local. Removal of vegetation from the construction area would not significantly increase soil erosion during rainfall since the vegetation is sparse. Protection against erosion would include:

- Orientation of any new facilities parallel to natural surface features to minimize drainage and erosion impacts
- Application of spray mist water to minimize wind-caused soil erosion
- Revegetation of temporarily disturbed areas.

4.9.2.4 Mitigation Measures. Because measures to reduce the level of impacts to geology and soils have been incorporated into the design and program plans for the Proposed Action at the CTF (e.g., plans to raise the level of new facilities above Birch Creek Playa flood zone levels), no additional mitigation measures would be required.

4.9.3 No-Action Alternative

Because no construction would occur with the No-Action Alternative, no impacts to geology and soils would occur at either of the SNTP alternative sites.

4.10 NOISE

Noise sources associated with SNTP activities primarily include those associated with equipment required for construction of the PBR validation test facility. These types of heavy equipment routinely generate noise levels of approximately 90 A-weighted decibels (dBA). While actual noise limits vary depending on the total time of daily exposure, the Occupational Safety and Health Administration (OSHA) limit for an 8-hour exposure is 90 dBA; the OSHA limit for 15 minutes or less is 115 dBA (see Figure 3.10-1). Testing activities are expected to generate noise levels of approximately 125 dBA for short infrequent periods but would be intermittent during the scheduled operational testing sequence. Because a noise level of 125 dBA *is attenuated to 60 dBA at a distance of 2,400 feet, no non-project-related personnel or sensitive community receptors* would be close enough to be adversely affected by PBR validation testing activities.

4.10.1 SMTS

Construction noise would be monitored by the Safety Office at NTS and workers in the vicinity of the construction equipment would be required to wear appropriate hearing protection. The closest sensitive community receptors to the SMTS that could be affected by construction noise levels are located approximately 23 miles away and would likewise not be affected.

During test activities, all non-essential personnel would be restricted from the SMTS site during testing and relocated three miles away; operating personnel would remain in the control complex (which has been designed to provide a barrier to sound penetration) during testing activities. Supplemental hearing protection inside the bunker would also be available.

Mitigation measures at the SMTS would include the following:

- OSHA-required hearing protection during construction activities when levels exceed 90 dBA

- Restriction of non-essential personnel from the ground test site during testing activities

- Protection of operational personnel in the control complex with supplemental hearing protection during activities.

4.10.2 CTF

Although less construction activity is anticipated at the CTF site, SNTP program activities would generate comparable noise levels during construction and testing activities as at the SMTS. The nearest non-project-related INEL personnel are located approximately 1.3 miles from the CTF site, and the nearest sensitive community receptors are located 11 miles away.

Mitigation measures at the CTF would include the following:

- OSHA-required hearing protection during construction activities when levels exceed 90 dBA

- Restriction of non-essential personnel from the ground test site during testing activities

- Protection of operational personnel in the control complex with supplemental hearing protection during activities.

4.10.3 No-Action Alternative

Because no construction or facility modification would occur with the No-Action Alternative, no noise impacts would occur at either SNTP alternative site.

4.11 WATER RESOURCES

4.11.1 SMTS

4.11.1.1 Groundwater. Groundwater in the area of the test site is 1,650 feet below ground surface in a tuffaceous aquifer. During PBR test site construction, 16 million gallons of groundwater would be extracted. During test operations, 3 million gallons per year would be withdrawn. This demand, in addition to existing water withdrawal, is not expected to cause a measurable drawdown of the existing water table.

4.11.1.2 Surface Water. There are no surface water resources in the vicinity of the SMTS and, therefore, no impacts are projected.

4.11.1.3 Water Quality. Domestic wastewater products (sanitary sewage) would be delivered to a septic system. Groundwater is of sufficient depth

that the possibility of adversely affecting its quality from this system would be negligible.

Accidental spills would be minimized by Pollution Prevention Plans and cleaned immediately to prevent groundwater contamination.

4.11.1.4 **Mitigation Measures.** Because no impacts to water resources would result from PBR validation test facility activities, no mitigation measures would be required.

4.11.2 CTF

Five hundred billion gallons of water are withdrawn annually by all users from the Snake River Plain Aquifer; most of this water is used for agriculture.

The DOE Idaho Operations Office has negotiated with the Idaho Department of Water Resources regarding a claimed water right for no more than 11 billion gallons annual withdrawal capacity under the Federal Reserved Water Rights Doctrine. The state of Idaho has signed a Settlement Agreement and public hearings have been held. Based on these hearings, an Interlocutory Order will be generated. INEL will abide by this order as it affects water use until the adjudication process is complete (DOE, 1991a).

4.11.2.1 **Groundwater.** The volume of water to be used during construction of the PBR validation test facility is approximately 2 million gallons and would be supplied from the in-place water supply system. This use of 2 million gallons would be a negligible increase in total use in the area (a very small fraction of the percent of total use). Construction water use represents about 1 gallon for every 1 million gallons of the annual discharge of the aquifer to the Snake River and about 1 gallon for every 300,000 gallons of the volume withdrawn by all users of the eastern Snake River Plain. Proposed construction (2 million gallons) and annual SNTP program water use (3 million gallons per year) would represent much less than 0.1 percent of the volume negotiated in the water rights agreement with the Idaho Department of Water Resources.

4.11.2.2 **Surface Water.** Surface water resources in the vicinity of the CTF include intermittent flows in Birch Creek and Big Lost River; however, no surface water withdrawal or discharges would occur during test facility construction. Because the PBR validation test activities would cause no measurable change in the projected baseline water resource system, the impacts of water use on water resources would be negligible. Flood potential of the CTF area is discussed in Section 3.9.2.1.

4.11.2.3 **Water Quality.** Domestic waste would be handled by an existing sewage system. Spills of hazardous substances could introduce pollutants

to the groundwater table but the potential would be minimized by immediate cleanup of accidental spills. Due to the lack of surface waters that would be affected and the depth of the water table, the impacts of wastewater on groundwater resources would be minor.

Because of the small amount of water being removed for SNTP, the withdrawal of groundwater by SNTP should not affect remediation efforts at TAN.

4.11.2.4 Mitigation Measures. Because no impacts to water resources would result from PBR validation test facility activities, no mitigation measures would be required.

4.11.3 No-Action Alternative

Because no construction or facility modification would occur with the No-Action Alternative, no impacts to water resources would occur at either of the SNTP alternative sites.

4.12 HEALTH AND SAFETY

The analysis of safety concerns associated with the SNTP program includes an evaluation of the potential radiation exposures that could result from normal test operations, routine transportation of radioactive materials, and the exposures that could result from test and transportation accidents. Included in the analyses were those credible accidents with the greatest potential adverse consequences (bounding accidents). The results of these analyses indicate that applicable regulatory limits would never be exceeded during normal operations or as a result of credible accidents. To provide some design margin within regulatory requirements and in keeping with the ALARA philosophy, the SNTP program has adopted the goal that all system facilities, equipment, and test procedures will be designed so as not to exceed 20 percent of the applicable regulatory limits.

Normal PBR validation tests would release very small amounts of radioactive material. For this analysis, the maximum radiological exposure to a person off site was calculated as the exposure of one hypothetical person who remains, unshielded, at the location of the highest concentration of dispersed materials for 50 years. That hypothetical person is called the maximally exposed individual (MEI). Because no person would ever be exposed to the maximum radiation from all the tests by being at exactly the right point for 50 years (although most of the exposure would occur soon after a test, during passage of the radioactive-material cloud), the MEI dose is defined as the dose occurring at the MEI location.

Section 4.12.1 presents the safety analysis and mitigation process which will be applied to this program. Section 4.12.2 presents the regulatory

requirements which apply to radioactive exposure and the potential impacts associated with this test program. Computer modeling techniques are used to develop and analyze the potential radiation exposures produced by normal operations of the test reactor and transportation of radioactive materials. Similar computer modeling studies are presented for bounding case reactor and identifiable transportation accidents. Results of these studies indicate that applicable regulatory limits are never exceeded either during normal operations, or as a result of credible accidents, and the proposed validation test program poses minimal adverse risk to individuals in the vicinity of NTS and INEL, and along possible transportation routes. Appendix E provides additional information concerning the analyses presented in this section.

For normal operations (i.e., no accidents), a regulatory standard applicable to public exposures (National Emissions Standards for Hazardous Air Pollutants [NESHAP]) of 10 millirems (mrem) annual exposure to the highest exposed individual is established by the Environmental Protection Agency (EPA). The SNTP program goal is 20 percent of this standard, or 2 mrem per year. Using a set of "model operating conditions" for weather, and the number of operations expected in a maximum-case year, modeling of bounding case normal operations yields the following MEI doses:

- NTS: 0.6 mrem
- INEL: 1.35 mrem

These values are well below both the regulatory standard and the SNTP program goal. Even routine medical procedures such as a single chest X-ray (2 mrem) result in larger individual exposures than are projected for this program (Greaney, 1992).

Accidents that may occur during testing could release larger amounts of radiation than normal operations. The accidents analyzed are those that could result from credible failures of system components. The results of those component failures were calculated assuming the credible conditions that produce the greatest possible impacts.

For accidents, a design limit of 500 mrem for a single, accidental, 24-hour exposure has been established based upon guidance in American National Standards Institute/American Nuclear Society (ANSI/ANS) Report 15.7. The bounding accident involves discharging a PBR Integral Performance Element Test (PIPET) core into the Effluent Treatment System (ETS), followed by the failure of the most critical ETS component (i.e., the component whose failure could result in the greatest off-station impact). This scenario assumes that, at the time of core failure, the core contained the maximum available fission product inventory and that the events leading to the release of radiological material to the environment occur after the weather conditions required for testing can no longer be assured. The analysis used significantly deteriorated weather conditions to evaluate this scenario and

produced the following MEI results, which are well below the ANSI/ANS guidance of 500 mrem:

- NTS: 23.5 mrem
- INEL: 30.0 mrem

Figure 4.12-1 provides a graphical summary of these results, along with applicable regulatory criteria and exposure guidance. This figure also portrays the environmental radiation doses at NTS and INEL for comparison. Appendix H provides additional information concerning ionizing radiation, its biological effects, and exposure evaluation; and is provided to aid the reader with the terms used in this analysis.

Section 4.12.3 presents non-radiological hazards associated with construction of the test facility, and operation of the PBR validation test program is discussed. Areas considered include transportation, storage and handling of cryogenic (low-temperature) fluids, facility construction, and management of hazardous materials. Evaluations are presented which include hazards associated with planned operations, as well as possible accident occurrences. In all cases, potential hazards are found to be controllable, and do not present adverse impacts to individuals, the community, or the test sites.

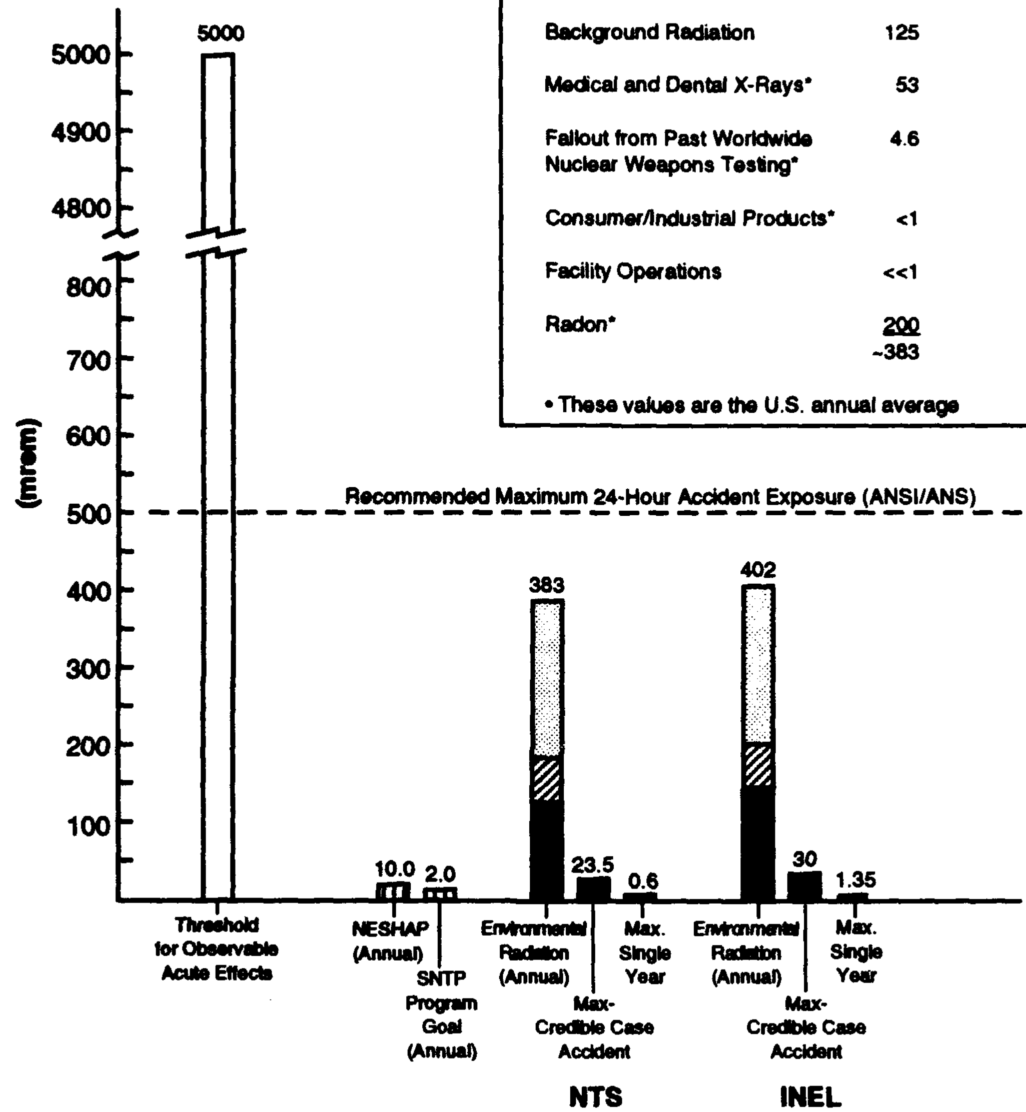
Section 3.12.1 provides a discussion of each site's emergency response procedures and accident recovery plans. The procedures are currently in place at each site, and are intended for use in the event of an accident.

4.12.1 Safety Analysis Review Process

The DOE, in accordance with its statutory responsibility under the Atomic Energy Act of 1954 (as amended), would require Safety Analysis Reports (SARs) to be submitted and approved prior to the construction and initial nuclear operation of the PBR validation test facility. This established SAR process, which is applied to all DOE reactors, would document the adequacy of the safety analysis for the PBR validation test facility to ensure that this facility can be constructed, operated, maintained, shut down, and decommissioned safely and in compliance with applicable laws and regulations. An overview is provided of the SAR process promulgated by two DOE Orders: DOE Order 5480.6, which requires that a safety program be established for each DOE nuclear reactor to ensure proper consideration of safety issues in all phases of reactor design, construction, operation, and decommissioning; and DOE Order 5480.23, which establishes uniform requirements for the preparation and review of SARs which describe the safety program and analyses. Major features of an SAR are described, as are the several steps through which every SAR must proceed prior to construction and operation of the facility.

Contributions to Individual Environmental Radiation Exposure		
Source	NTS	INEL
Background Radiation	125	144
Medical and Dental X-Rays*	53	53
Fallout from Past Worldwide Nuclear Weapons Testing*	4.6	4.6
Consumer/Industrial Products*	<1	<1
Facility Operations	<<1	<<1
Radon*	200	200
	~383	~402

• These values are the U.S. annual average



EXPLANATION

- Background Radiation
- Other Sources
- Radon
- Exposure Guidelines
- PBR Impacts

Magnitude of Dose Impacts to Maximally Exposed Individual

Figure 4.12-1

An SAR includes the documentation of a series of analyses performed to indicate the impacts to the environment caused by the facility under normal operating conditions and credible departures from those normal conditions. These "off-normal" situations may be the result of internal events, such as component failures or operator errors, or external events, such as earthquakes or loss of off-site power supplies. The SAR would demonstrate that all such eventualities have been considered and are at least bounded by the analyses presented. The analyses would address both the probability of these events occurring and the potential resulting consequences. If either the probability or the severity of a given scenario is of sufficient concern, the system may be required to include safety measures or features to mitigate that specific risk. The SAR would then include detailed assessments of those safety features. Moreover, if the SAR process reveals credible circumstances more severe than those analyzed in this EIS, a supplemental environmental analysis would be performed.

Another major component of an SAR would be the description of those accidents which, based on their probabilities, potential consequences, or the fact that they constitute a bounding case for other accident sequences, have been selected for analysis. These accident analyses would identify some of the design requirements which must be met by the proposed system and are usually referred to as design basis accidents. Safety analyses also often consider accidents, and system responses to those accidents, more severe than design basis accidents; these analyses are reported as supporting information to the approval process.

The SAR process would also include all identified safety concerns in the design development process to ensure their proper consideration. The process would also provide clear safety design requirements and specifications, limits on operating conditions, and Technical Safety Requirements (per DOE Order 5480.24).

An SAR must pass through several levels of approval, including at each level some measure of independence between those reviewing, commenting upon, and approving the work and those who prepared the material. The following description is keyed toward the SAR process for the PBR propulsion technology development and validation throughout the life of the test program.

First, the system design team develops a design of the hardware and operations systems which meets the SNTP program performance requirements. Concurrent with this activity, the safety team analyzes the in-progress design and identifies potential hazards associated with the system, and all applicable laws, regulations, and codes, and determines the additional design requirements necessary to ensure that safety has been considered adequately and is reflected in the design.

Second, the design is reviewed internally within the SNTP program organization. Safety is given top priority in all program activities.

Third, the SAR would be reviewed by the DOE reactor operating contractor organization. Typically, this is a two-level review. The first level is primarily a technical review, and is comprised of individuals not directly involved in the development of the system under review but having the technical expertise to judge the adequacy of the design to meet its requirements, especially those addressing the safety of the system and its operation. The second level is at a management level, again, representing appropriate technical expertise and expressly including management representatives from safety and health physics organizations. This oversight would continue throughout the life of the test project.

Fourth, the SAR is submitted to DOE. Review at DOE begins at the Field Office level and independent safety review experts are typically assembled into a review team. The SAR would then be reviewed and approved by DOE Headquarters. DOE Headquarters' review is documented in a Safety Evaluation Report (SER), which would allow either construction if approving the Preliminary SAR, or operation if approving the Final SAR. After initiation of construction or operation the DOE reactor operating contractor would be held responsible by DOE for adhering to the assumptions and commitments set forth in the SAR.

After the SAR is approved, DOE Orders require that it be updated and reapproved periodically. Additionally, modifications to the test program which are promulgated between reapprovals of the SAR would be evaluated for impact on safety.

Throughout the facility design and approval process, end-of-life requirements are considered to ensure that (1) appropriate decontamination and decommissioning are feasible and (2) design features to enhance the effectiveness of decontamination and decommissioning procedures are included. Finally, as the program approaches completion, detailed decontamination and decommissioning plans are developed and subjected to a review process similar to that described above.

4.12.2 Radiological Hazards

Radiological exposure hazards associated with the SNTP program have three potential sources:

- PBR validation test activity operational releases
- PBR validation test activity accidental releases
- Transportation and handling of radioactive material.

At NTS a fourth potential exposure source, which has been eliminated from consideration, is resuspension of surface uranium/plutonium contamination. SNTP activities would not occur in areas where such contamination is known to be present, nor will any activities or possible accidents have the potential to affect these areas and cause resuspension of contamination.

4.12.2.1 **Radiological Release Assessment Methodology.** The radiation exposures reported as results of normal operations and plausible accident scenarios are maximum potential exposures. To present a conservative analysis (i.e., one that gives high estimates of impacts), factors that would affect the results, such as amount of material released and weather conditions, were selected to produce a bounding estimate of the impact. Assessments were performed using computer models and information describing normal operations and plausible accident scenarios.

Included in accident scenario development was consideration of multiple concurrent hydrogen explosions, which were found to induce no added impacts for any of the identified analysis scenarios. Because the hydrogen would have to be mixed with the oxygen in atmospheric air, because the volumes inside the reactor vessel which might be filled with a hydrogen/air mixture are so small, and because the over-pressures generated in an open hydrogen/air explosion are not sufficient to challenge the integrity of the reactor vessel, there is no expectation that hydrogen accidents will increase either the probability of occurrence or magnitudes of radiological hazards.

A complete discussion of the development of the methodology is provided in Appendix E, Section 1.0.

Model Selection

Several computer models were considered for the analysis of radiological impacts from reactor operations and accidents. Among these are Airdos-PC, CAP-88, RSAC-4, and MACCS. MACCS was selected for use with this safety analysis because of its ability to handle a large number of isotopes and to evaluate short-term releases such as those associated with PBR validation tests. Of the models considered for this application, MACCS yields the most conservative results. All radiological impact analysis results in this EIS were obtained from MACCS modeling.

As required by 40 CFR 61, National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H, either Airdos-PC or CAP-88 will be used to demonstrate compliance with air emission standards.

Radiation exposures from transportation of radioactive materials and the risk of exposures from transportation accidents were evaluated using

RADTRAN 4. That model was developed by Sandia National Laboratories (SNL) to specifically analyze the impacts of radioactive material transport.

Selection of Meteorological Conditions

PBR propulsion technology test reactor operations will occur over short periods of time (less than 1,000 seconds), and total test operations will last several hours from start to finish. This allows pre-test evaluation of prevailing meteorological conditions to ensure that potential impacts will be within acceptable program criteria. Prior to test operations, forecasting of meteorological conditions will be performed, which will encompass a period of approximately ten to twelve hours with a high degree of certainty. Real-time evaluation of radiological impacts that could result from an accident under these meteorological conditions would be used to determine whether or not to proceed with the test.

Since the acceptability of weather conditions is based upon real-time assessments of potential impacts in the event of an accident, individual weather parameters may vary over considerable ranges. However, to allow quantitative estimates of the potential impacts for this EIS, a set of "Model Weather Conditions" has been selected which meets acceptance criteria and occurs with high relative frequency at each test site. These are presented in Table 4.12-1 and are used for analysis of all normal operations and test-time accidents. Since the forecast reliability for duration of test weather conditions may be as short as 10 hours, it is conceivable that beyond that time weather conditions could change considerably. Such a change could create conditions which would not have been acceptable at the start of a test due to potential severity of accident impacts, but which could influence accident events occurring several hours after test completion. Table 4.12-2 presents such weather criteria, which, while not meeting test-start acceptance criteria, were selected as capable of producing maximal impacts. These conditions are used in the analysis of accidents occurring more than 10 hours after test-start.

At both NTS and INEL, meteorological conditions for each set of parameters were selected based upon data provided by the nearest NOAA-operated monitoring station to the proposed test sites (SMTS and CTF).

Radiological Releases

The "source term" represents the amount of radioactive material released to the environment. It is the product of the total core radiological inventory multiplied by applicable release fractions, and is the basis for impact determinations developed with MACCS. The source term can vary in magnitude based upon both the type and condition of the reactor involved

Table 4.12-1. Model Weather Conditions

	NTS	INEL
Air Stability Category	Neutral	Neutral
Wind Speed (meters per second)	5.5	5.5
Plume Direction[a]	NNE[b]	NNE[b]
Inversion Base Height (meters)	2,000	1,500

Notes: (a) Direction to which the wind is blowing.
(b) Generally in the northerly direction.

Table 4.12-2. Bounding Accident-Case Weather Conditions

	NTS	INEL
Air Stability Category	Moderately Stable	Moderately Stable
Plume Speed (meters per second)	1.0	1.0
Wind Direction	Towards the Highest Population	Towards the Highest Population
Inversion Base Height (meters)	300	300

(which affects the total amount of radioactive material available for release, referred to as the total core inventory) and the fractional amounts of each nuclide which escape to the environment.

Fission products, which are created during the fissioning of uranium fuel in the reactor core, account for more than 99 percent of the total core inventory, with the remainder consisting of activation products (materials made radioactive due to exposure to neutrons). Activation of hydrogen coolant was also considered (tritium production) (Sanchez, 1992), but the amount of tritium produced is negligible. This core fission product inventory is determined based upon both the length of time at which a core has been operated and the power level of the operations. In this impact evaluation, determination of the core fission product inventory is based upon the following maximum-case test operations:

- PIPET:
  A series of five tests, with each test consisting of an operational power level of 550 megawatts operating for a period of 500 seconds. During each individual test run the value of the total core inventory increases due to production of additional fission products

- GTA:

  One operation of 2,000 megawatts for 1,000 seconds.

Reactor test operations will not result in core inventories greater than those described by these maximum-case tests; however, other test schemes may occur (e.g., multiple lower power or shorter run-time GTA tests) which will produce this inventory.

Once core inventories have been calculated, it is necessary to determine the amount of each isotope which would be released from the core. In the event of accidents, or for tests that evaluate design limits, it is conservatively assumed that the entire core inventory is released to the ETS.

For other types of operations, calculations have been performed to estimate the quantities of isotopes released. Of the total number of isotopes present in the core, the release fractions of 55 radionuclides (representing more than 75 percent of the radiological impact potential) have been calculated specifically, and are presented in Table E-5 of Appendix E. Conservative assumptions have been made concerning the release fractions of the remaining inventory isotopes through classification of nuclides into four chemical groups; for each of these groups, unique percentage release values have been developed. These values are presented in Table E-6 of Appendix E. Fission products released from the core will enter the ETS, which has design goal retention efficiencies of 99.5 percent for volatiles, halogens, and nobles, and 99.9 percent for particulates. The final source term for each analysis is calculated by applying these ETS retention efficiencies to the fraction of the core inventory which is released, and determining the resulting quantities of radioactive material which are released to the environment.

Population Data

Population data for input to the MACCS model were obtained from the 1990 census reports for each site. For this assessment, the potential radiological impacts of PBR validation testing at distances up to 150 kilometers (93 miles) have been included in estimating total population exposures. This allows inclusion of major population centers near each proposed test location. Beyond this distance, the total population exposure will drop off rapidly, contributing little additional dose. (Although the contribution to total population dose from these outlying areas is very small, the calculations sometimes show the location of the MEI to be beyond 150 kilometers. Therefore, peak MEI doses at greater distances are included in the results reported here.)

For input into MACCS, population data are arranged into a circular (polar) grid divided into 16 directional sectors and 26 radial distances measured

from the release point outward to 150 kilometers (Figure 4.12-2). The size of each radial segment increases with distance from the release point. The areas considered around NTS and INEL are illustrated in Figures 4.12-3 and 4.12-4, respectively.

Potential Impacts

The results of the MACCS analyses provide two measures of potential impact:

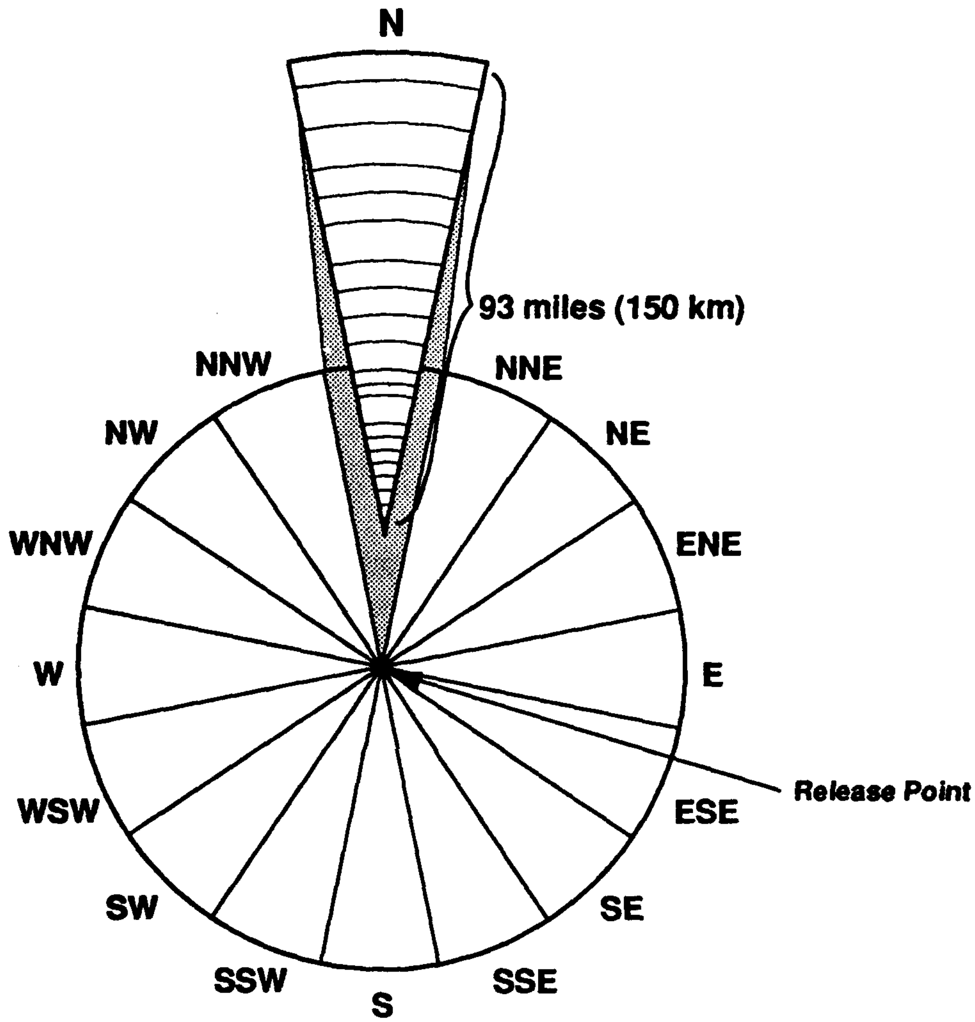
1) The location and magnitude of the maximum cumulative dose which could be received by any individual, referred to as the "Maximally Exposed Individual" (MEI). The MEI dose is expressed in mrem, and represents the combined totals due to external and internal exposures.

2) The estimated total dose received in the exposed population as accumulated during a 50-year period following each release. The population dose is expressed in person-mrem, and includes the combined contributions due to external and internal exposures.

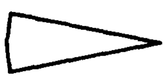
The summation of impacts from all operations in a Maximum Year yields an MEI dose which can be evaluated against both the NESHAP standard of 10 mrem and the SNTP program goal of less than 2 mrem total dose to any individual (see Section 4.12.2.2 below). The total population dose can be used to estimate the numbers of latent cancer fatalities and genetic defects that might occur in the exposed population. This population-dose analysis uses the no-threshold, linear response hypothesis for determination of health effects from low doses of radiation. That hypothesis is that there is no harmless dose of radiation, and the probability of developing cancer or suffering a genetic defect is directly proportional to the radiation dose received.

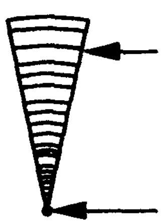
The total population-dose estimate is determined by applying average cancer and genetic disorder exposure risk criteria from the 1990 report issued by the Committee on the Biological Effects of Ionizing Radiation (referred to as BEIR V) (Biological Effects of Ionizing Radiation [BEIR], 1990), which are 0.00000079 (7.9×10^{-7}) latent cancer fatalities per person-mrem and 0.00000021 (2.1×10^{-7}) genetic effects per person-mrem. This analysis provides estimated numbers of induced latent cancer fatalities and genetic disorders expected based upon the projected radiological impacts. These estimates can be compared to the naturally expected rates of occurrence of these effects.

In the United States, the average expectation is that each year one person in 220 will develop cancer, and that each year one person in 4,545 will



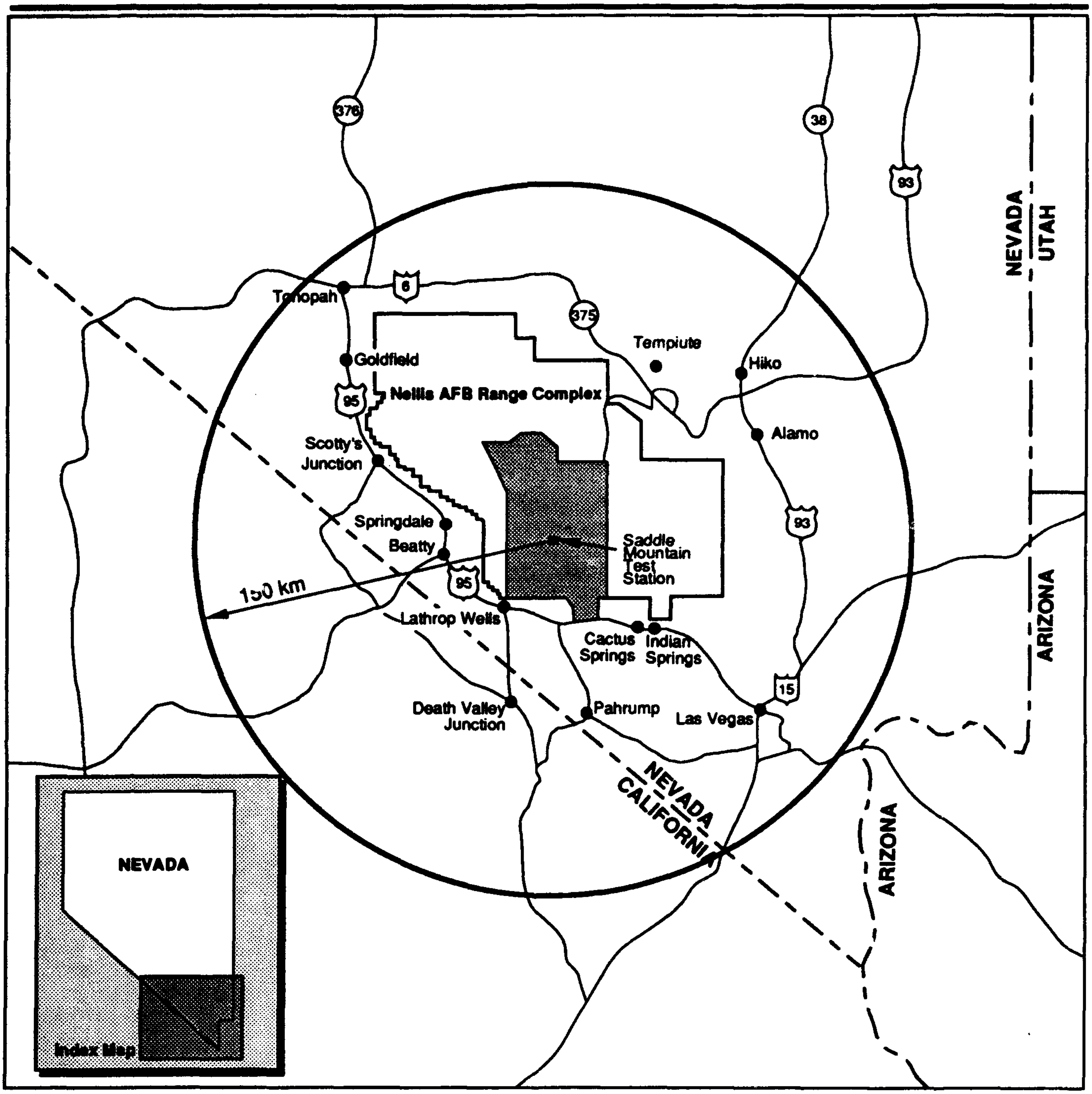
EXPLANATION

W  Directional Sector Modeled in MACCS



MACCS Polar Grid

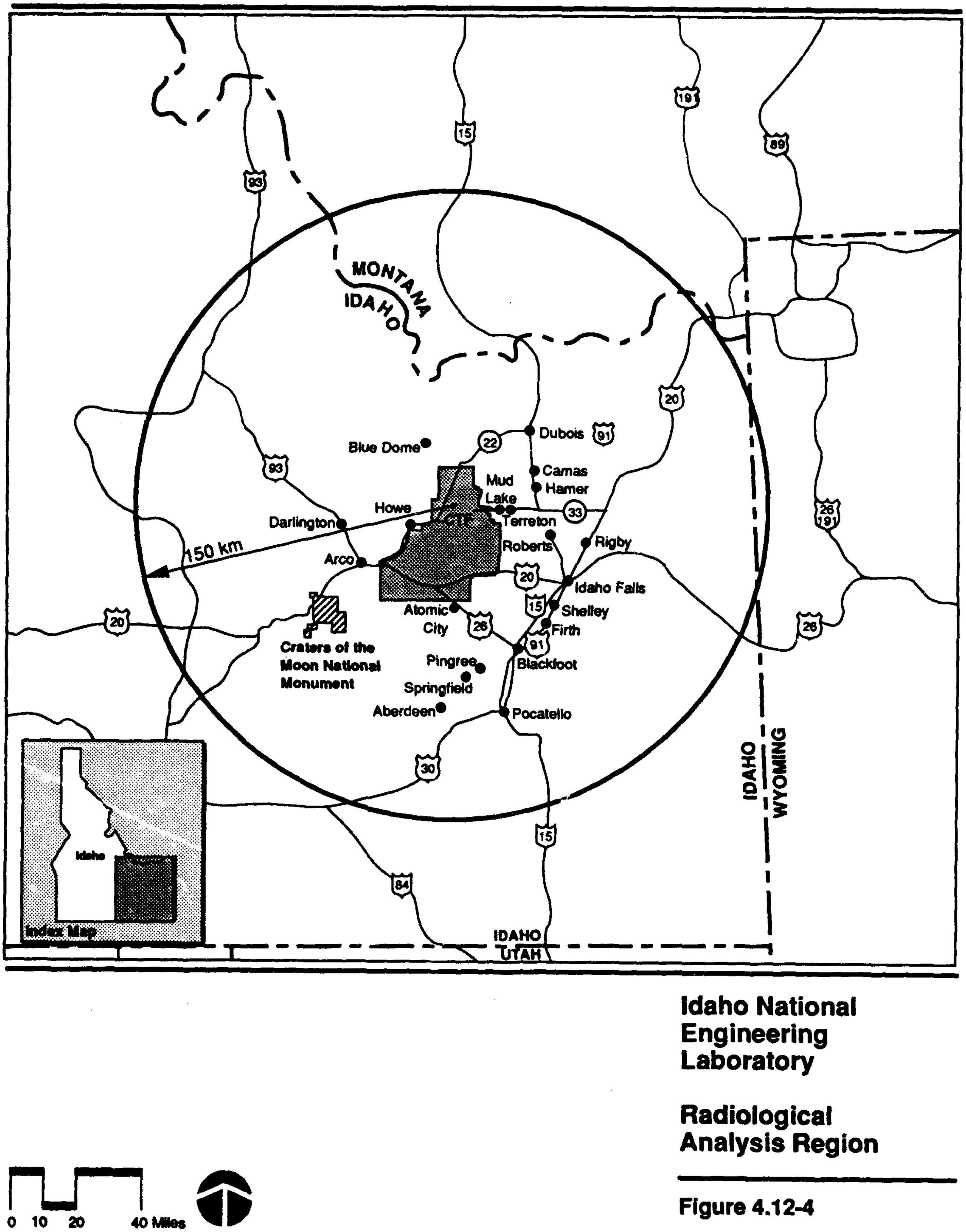
Figure 4.12-2



Nevada Test Site

Radiological Analysis Region

Figure 4.12-3



Idaho National Engineering Laboratory

Radiological Analysis Region

Figure 4.12-4

develop a genetic disorder (Mayernick, 1992). Among the 1,072,718 people in the vicinity of NTS, approximately 243,000 cancer fatalities and 11,800 genetic disorders would normally be expected over a 50-year period. Near INEL, the 278,635 people would normally expect to experience 63,300 cancer fatalities and 3,065 genetic disorders in 50 years.

4.12.2.2 Public Exposure During Normal Operations. 40 CFR 61, Subpart H (NESHAP) specifies an annual exposure limit of no more than 10 mrem per year to any individual. However, the SNTP Program has a design goal of 20 percent of this standard (2 mrem).

Normal, planned operations would entail the release of small quantities of radioactive materials (primarily noble gases, halogens, volatile elements, and some particulates) to the atmosphere. These represent materials released from core fuel particles which escape the ETS, as well as post-test release of noble gases and other volatile isotopes (held in the ETS for 1 day). Together the releases constitute the source term used in the MACCS analysis.

Categories of Operations

Operational tests have been divided into three categories based on the required performance of the reactor core; they are designated Normal I, Normal II, and Normal III. Varying numbers of tests in each category would be performed on the PIPET and GTA cores. Some combination of these tests would be conducted each year in the life of the program. The expected maximum number of tests in a year is presented in Table 4.12-3.

Table 4.12-3. Maximum Year Test Operations

Operation Type	Number
PIPET Normal II	9
PIPET Normal III	1
GTA Normal II	2
Total	12

Normal I. Normal I experiments include initial startup, zero-power, and low-power physics tests. These tests would not release any radioactive material to the environment, so they are not discussed or analyzed further or included in Table 4.12-3.

Normal II. Normal II experiments are standard tests that would operate within the fuel design envelope, up to the core's rated full power (550 MW

for PIPET and 2,000 MW for GTA). These experiments would release small amounts of the core inventory during each test. The amount of fission products released as a result of a Normal II operation would be the same as those discussed under Radiological Releases (see Section 4.12.2.1). PBR propulsion technology Normal II experiments would be performed using both GTA and PIPET cores.

Normal III. Normal III experiments, which would be performed using PIPET cores only, involve operations to determine fuel design margins, with the intent of quantifying actual design limits. These experiments would include over-power, reduced coolant flow, and extended duration testing, which may cause full or partial fuel element failure, and release of a fraction of the fuel in one or more fuel elements into the ETS. Current assessments of these experiments envision reduced run times (minimizing the inventory) with only partial failure of some of the fuel elements (minimizing the release). However, for purposes of performing conservative impact analyses, it is assumed that 100 percent of the core fission product inventory is released from the core following a maximum case test. It is important to realize that the intent of these tests is to define the design margin, not to purposely fail the core.

Program Impacts from Normal Operations

The health and safety impacts of PBR validation normal operations are presented as the *cumulative impacts* of the 10-year test program. The program would comprise an average of five PIPETs and one GTA test per year for a total of 60 test operations involving nuclear materials. During the 10-year program, all GTA tests would be Normal II and all but four PIPETs would be Normal II. The remaining four PIPETs would be Normal III tests. The maximum-case year of normal operations (a total of 12 tests, or 20 percent of all program operations) is shown in Table 4.12-3. Each test is assumed to be a full-power, maximum-duration test. The impacts from individual tests are presented in Appendix E, Section 2.0.

Impact Assessment

The reported radiological doses are the sum of the external doses and the organ-weighted internal doses, integrated over 50 years. The internal dose includes that received from inhalation during cloud passage, later inhalation of resuspended radioactive particles, and ingestion of contaminated food and water. Although the dose is integrated over 50 years, most of it would be received during radioactive material cloud passage; almost all of the dose would be received in the first year after the release. Tables 4.12-4 and 4.12-5 show the MEI and population doses, respectively, for the total of all releases in the maximum-test year (12 tests). Tables 4.12-6 and 4.12-7 present the total impacts for the 10-year program life (60 tests). These results represent a very conservative estimate of the potential radiological

impacts, representing the maximum potential upper bound for exposures. It can be expected that actual impacts would be considerably smaller.

Maximum Annual Operations. Tables 4.12-4 and 4.12-5 show the MEI and population doses, respectively, for the maximum yearly total release. The highest total dose at the NTS boundary following the maximum yearly release from the SMTS would be approximately 0.16 mrem. The location of the MEI would occur at approximately 195 kilometers (121 miles) at a dose of 0.60 mrem. The highest total dose at the INEL boundary following the maximum yearly release at the CTF would be approximately 0.09 mrem. The location of the MEI at INEL would occur at approximately 125 kilometers (78 miles) at a dose of 1.35 mrem. These values are well below both the NESHAP standard of 10 mrem and the SNTP program goal of 2 mrem.

Table 4.12-4. Maximum Yearly Release 50-Year Center-Line Dose to the MEI

	Site Boundary		Peak Dose		1-year Natural Radiation
Site	Dose (mrem)	Distance (km)	Dose (mrem)	Distance (km)	Dose (mrem)
NTS	0.16	39	0.60	195	383
INEL	0.09	15	1.35	125	402

Population doses for the maximum yearly release result in the projection of approximately 0.02 additional cancer fatalities and 0.01 additional genetic disorders at NTS, and the projection of approximately 0.11 additional cancer fatalities and 0.03 additional genetic disorders at INEL.

PBR Propulsion Technology Development and Validation Impacts. Tables 4.12-6 and 4.12-7 show the MEI and population doses, respectively, for the entire proposed PBR propulsion technology assessment. The highest total dose at the NTS boundary due to these PBR activities would be approximately 0.64 mrem. The location of the MEI would occur at approximately 190 kilometers (118 miles) at a dose of 2.5 mrem. The highest total dose at the INEL boundary due to these PBR activities would be approximately 0.50 mrem. The location of the MEI at INEL would occur at approximately 125 kilometers (78 miles) at a dose of 5.6 mrem.

Population doses for the entire proposed PBR propulsion technology assessment result in the projection of approximately 0.09 additional cancer fatalities and 0.024 additional genetic disorders at NTS, and the projection of approximately 0.44 additional cancer fatalities and 0.12 additional genetic disorders at INEL. These projected impacts are very small in

Table 4.12-5. Maximum Yearly Release 50-Year Population Dose

							Latent Cancer Fatalities		Genetic Disorders	
Site	Maximum Sector	Direct Exposed Population	Direct Pop. Dose (Person-mrem)	Ingestion Exposed Population	Ingestion Pop. Dose (Person-mrem)	Total Pop. Dose (Person-mrem)	Additional Cases	Increase Above Expected (%)	Additional Cases	Increase Above Expected (%)
NTS	NNE	917	114	1,072,718	27,457	27,571	0.022	0.000009	.006	0.000051
INEL	N	6,959	2,359	278,635	131,547	133,906	0.106	0.00017	0.035	0.0014

Table 4.12-6. Total SNTP Program Cumulative Center-Line Dose to the MEI

Site	Site Boundary Dose (mrem)	Site Boundary Distance (km)	Peak Dose Dose (mrem)	Peak Dose Distance (km)	10-Year Natural Radiation Dose (mrem)
NTS	0.64	39	2.5	190	3,830
INEL	0.50	15	5.6	125	4,020

comparison to the expected number cancers and genetic disorders in these populations.

4.12.2.3 **Public Exposure as a Result of Potential Accidents.** For the ground test facility, the ANSI/ANS Report 15.7 has been identified as providing the most conservative siting guidance. This standard is jointly established by the ANSI and the ANS for application to test reactors, and represents a conservative limit which should be allowed for public exposure as a result of an accident. The maximum allowable doses to an off-site individual from a reactor accident specified in ANSI/ANS Report 15.7 are 500 mrem whole body and 1,500 mrem to any organ, accumulated from a 2-hour exposure for rural populations or a 24-hour exposure for urban populations.

ANSI/ANS Report 15.7 defines radiological dose limits in terms of zones around the test facility. The innermost zone, the operations area, is that area in the immediate vicinity of the test facility set off by a physical barrier such as a fence over which the test facility administrator has access and activity control. The operations area is surrounded by a site, in which there may be people only generally aware of test facility activities and emergency responses. Outside the site is a rural zone, generally an area that may include members of the general public, but limited to populations which could reasonably be evacuated or protected within 2 hours. The urban zone (i.e., the area outside the rural zone) includes populations too large (greater than 25,000) to assume such evacuation or protection; instead an exposure time of 24 hours is assumed.

Categories of Accidents

An accident involving a GTA or PIPET core could result in a radioactive material release to the environment that would have a greater health and safety impact than the releases resulting from normal program operations. There could be a release of a considerably higher fraction of the core inventory and/or a premature release from the ETS. Several accident scenarios have been evaluated to determine which credible accident would

Table 4.12-7. Total SNTP Program Release 50-Year Population Dose

							Latent Cancer Fatalities		Genetic Disorders	
Core/ Site	Maximum Sector	Direct Exposed Population	Direct Pop. Dose (Person-mrem)	Ingestion Exposed Population	Ingestion Pop. Dose (Person-mrem)	Total Pop. Dose (Person-mrem)	Additional Cases	Increase Above Expected (%)	Additional Cases	Increase Above Expected (%)
NTS	NNE	917	487	1,072,718	112,956	113,443	0.09	0.000037	0.024	0.00019
INEL	N	6,959	9,638	278,635	542,876	552,514	0.44	0.00070	0.12	0.0046

have the greatest radiological impacts. The accident scenarios that were evaluated were designated Consequence I, Consequence II (Early), Consequence II (Late), and Consequence III.

Consequence I. A Consequence I accident is not a credible scenario; it is the hypothetical, maximum-release accident. It assumes the release from the core of all radioactive material in a maximum-inventory GTA core immediately following operation. To accomplish this, the core inventory is assumed to be completely aerosolized, and to remain aerosolized during dispersal. The released inventory is assumed to bypass the ETS and secondary confinement and be released directly to the environment. All of these assumptions are overly conservative; none could be realized physically. The impact of a concurrent hydrogen explosion was also considered but did not increase radiological consequences.

Consequence II. A Consequence II accident is considered the maximum credible postulated accident scenario. A Consequence II accident could be the result if both the cryogenic adsorber beds and the ETS confinement systems were to fail simultaneously subsequent to a Normal III experiment which resulted in fuel element failure. Such a double, simultaneous failure of independent systems is very unlikely but considered credible for this analysis.

For conservatism, 100 percent of the PIPET core is assumed to be released into the ETS. All the noble gas inventory is assumed to be released into the atmosphere. The other radioactive materials, e.g., solid particles and halogen gases, would be trapped in the ETS particulate and charcoal filter media and thus not released.

Since the design margins for PBR fuel elements will have already been characterized in PIPETs, GTA cores will not be subjected to Normal III operations. Therefore, in addition to the simultaneous failure of the adsorber beds and the confinement systems, any release from a GTA core would require an additional failure to precipitate disruption of the core. The simultaneous occurrence of three independent failures is not credible. Therefore, a Consequence II accident involving a GTA is considered to be unrealistic and is not included in these analyses.

Two different failure times are considered. The first occurs immediately following the end of a PIPET Normal III operation. Model weather conditions are assumed, since this release would occur within the 10-hour forecast window. This accident is termed the Consequence II "Early" scenario.

Should the adsorber beds fail more than 10 hours after the test, model weather conditions can no longer be assumed. Instead, credible weather conditions which produce the maximal impact are assumed to prevail (moderately stable air, 1.0 meter per second wind speed, and a 300-meter

inversion layer base). Additionally, the wind is assumed to be blowing directly toward the nearest maximum population center (Las Vegas at NTS or Idaho Falls at INEL). This accident is termed the Consequence II "Late" scenario.

Hydrogen coolant from PIPET and GTA tests would pass through the ETS and be burned in a flare as it exited. If hydrogen were to mix with air at any point other than in the flare, there could be a fire/explosion hazard. To prevent hydrogen/oxygen mixtures in the ETS, the system would be purged of air with pressurized helium and operated under positive pressure to prevent reinfiltration of oxygen. To guard against hydrogen escaping from the ETS without being burned in the flare, the ETS would be thoroughly inspected for leaks and monitored during tests, and the flare would have redundant pilot lights. No hydrogen-detonation scenario was found to have radiation-exposure consequences as great as the Consequence II (Late) scenario. The non-nuclear hazards of hydrogen are discussed in Section 4.12.3.2.

Consequence III. During initial installation of a GTA or PIPET core, some zero or low-power testing (Normal I operations) would be conducted. Although highly unlikely, an accidental reactor control rod withdrawal could occur before the reactor containment and confinement system are in place. In this event, the reactor would experience a brief, but intense, power excursion which could result in fuel vaporization and subsequent release directly into the atmosphere. The resulting inventory would contain fission products equivalent to operating a GTA at approximately 110 MW for 0.5 seconds (Sherman, 1992), and would be released at ground level. The effect of a concurrent hydrogen explosion was also considered and did not increase the radiological consequences. Although the intent would be to perform the zero-power testing in model weather conditions, weather conditions producing the maximal impact are assumed for conservatism (moderate stability, 1.0 meter per second wind speed, and a 300-meter inversion height). Additionally, the wind is assumed to be blowing directly toward the nearest maximum population center (Las Vegas at NTS or Idaho Falls at INEL).

Bounding Case Accident Impacts

Analysis of these accident scenarios has shown that the Consequence II (Late) accident would have the greatest radiological impacts. The potential for occurrence of this type of accident is remote, since it would require the simultaneous failure of two independent reactor systems. The probability of failure of either system is low; the simultaneous failure of both is almost inconceivable.

Tables 4.12-8 and 4.12-9 list the MEI and population dose, respectively, for the Consequence II "Late" accident. The site boundaries for this accident

Table 4.12-8. PIPET, Consequence II "Late" Accident Plume Center-Line Dose to the MEI

Site	Site Boundary		Peak Dose		1-Year Natural Radiation
	Dose (mrem)	Distance (km)	Dose (mrem)	Distance (km)	Dose (mrem)
NTS	23.5	23	23.5	23	383
INEL	24.0	3	30.0	10	402

are reported closer to the release point (23 kilometers [14.26 miles] at NTS, and 3 kilometers [1.86 miles] at INEL) than was used in the Normal-case operations analyses as a result of the wind direction changes. At INEL, determination of site boundary is set by a public highway which travels within 3 kilometers of the CTF, since non-site personnel may have access to this location after test operations.

The maximum dose at the NTS boundary for this accident occurring at SMTS is approximately 23.5 mrem, which is also the MEI location and dose. At the INEL site boundary of 3 kilometers, the maximum dose from occurrence of this accident is approximately 24 mrem, while the INEL MEI dose of 30 mrem occurs at a distance of 10 kilometers (6.2 miles). Although these values do not take into account the effects of evacuating, they are well below the ANSI/ANS Report 15.7 guideline of 500 mrem (0.5 rem).

Population doses as a result of a Consequence II "Late" accident are evaluated in the southeast (SE) wind sector for NTS (i.e., Las Vegas), and the SE sector at CTF (i.e., Idaho Falls). The projected latent effects which may be caused by the Consequence II "Late" accident are approximately 0.37 additional cancer fatalities and 0.10 additional genetic disorders at NTS, and approximately 1.4 additional cancer fatalities and 0.36 additional genetic disorders at INEL. These values represent the maximum accident-case impacts for PBR propulsion technology assessments.

4.12.2.4 Worker Exposure

Regulatory and Design Criteria

On-station workers may potentially be exposed to radiation due to operation of the PIPET and GTA reactors, as well as the subsequent decay radiation from core inventories. DOE Orders specify a limit of 5,000 mrem per year for radiation workers. The recently released DOE Radiological Control Manual (DOE, 1992i) suggests a design goal for limiting annual worker

Table 4.12-9. PIPET, Consequence II "Late" Accident 50-Year Population Dose

Site	Maximum Sector	Direct Exposed Population	Direct Pop. Dose (Person-mrem)	Ingestion Exposed Population	Ingestion Pop. Dose (Person-mrem)	Total Pop. Dose (Person-mrem)	Latent Cancer Fatalities		Genetic Disorders	
							Additional Cases	Increase Above Expected (%)	Additional Cases	Increase Above Expected (%)
NTS	SE	974,109	401,000	1,072,718	64,000	465,000	0.37	0.00015	0.10	0.00085
INEL	SE	66,441	360,000	278,635	1,361,000	1,721,000	1.4	0.00022	0.36	0.015

operational exposures to 500 mrem. In order to provide an adequate margin for dose limits such that special operations (which may entail planned additional exposures) can be performed, the yearly averaged facility occupational dose rate must be maintained at a level significantly below that which would result in the general facility worker receiving a maximum annual dose allowance. To provide this margin, the design objective is to limit normal operational exposures to 20 percent of 500 mrem, i.e., 100 mrem. Assuming that a worker is on site for 8 hours per day for 236 days per year, this is equivalent to 0.053 mrem per hour.

Normal Operations

Some maintenance activities would require workers to be in the vicinity of reactor cores, which would present a considerable dose potential. The reactor cores would have to be shielded to keep the exposure levels at or below 0.053 mrem per hour. Dose-rate calculations based on assumptions about the radiation levels external to the reactor cores provide a basis for establishing shielding requirements. These calculations were made using the computer codes Microshield (for lateral shielding) and Microskyshine (for overhead shielding).

Depending on final design and procedures for the tests, approximately 1.4 to 2.0 meters (4.2 to 6.6 feet) of concrete laterally and 0.7 to 1.0 meters (2.1 to 3.3 feet) overhead would be required to permit a worker to be within ten meters (33 feet) of the source on a regular basis. (The calculations of overhead shielding requirements assume that work would not be performed directly above the source on a regular basis.)

The population dose for all on-site radiation workers cannot be calculated until facility designs have been fully developed. Operational procedures will be designed to keep exposures as low as reasonably achievable (ALARA); personnel who are not required for the execution of a test will be evacuated from the facility during actual tests. However, the total population dose can be conservatively estimated using the assumption that all workers will receive the design-goal limit of 500 mrem per year.

The test facility population during operations is expected to include a maximum of 150 persons. A conservative estimate of the total population exposure for the 10-year life of the program would be:

150 persons x 500 mrem/yr x 10 years = 750,000 person-mrem.

Based on that conservative estimate about exposures and the BEIR V cancer-incidence rate, the excess latent cancer fatality risk is 0.6. The SNTP Program goal for exposures to non-program-related personnel (i.e., workers involved in other activities at NTS and INEL) is 20 mrem per year. The workday populations at NTS and INEL are approximately 4,500 each. A

conservative estimate of the total population exposure over the life of the program would be:

4,500 persons x 20 mrem/yr x 10 years = 900,000 person-mrem

Based on those conservative estimates about exposures and the BEIR V cancer-incidence rate, the additional latent cancer fatalities for each site is 0.71.

Test Accidents

On-station personnel at the PBR test facility would be at risk in the event of test facility accidents, both industrial and radiological. The risks would be minimized by adherence to all applicable safety standards and special guidelines for the construction, operation, and decommissioning of such facilities; in all its phases, the PBR technology development program is committed to reducing all risks to ALARA levels. During test operations, when potential risks or accidental radiological exposures are greatest, all unnecessary personnel would be evacuated from the facility. Those who must remain on-station would be housed in a conservatively designed control bunker until the test is completed and the hazard is reduced to an acceptable level.

Doses to on-site (NTS or INEL) workers not assigned to the PBR facility following an accident can be estimated using the bounding Consequence II "Late" accident calculation. This accident scenario produces the bounding exposure rates for distances greater than 3 miles from the release point, and at both candidate locations, the largest worker populations are more than 3 miles from the test facility. Except for distances less than approximately 3 miles from the release point, this accident bounds all others (the Consequence III accident is somewhat larger closer in).

The short-term, total-population dose to NTS workers was estimated assuming that all 4,500 of them are in Mercury, Nevada, unsheltered at the time a Consequence II (Late) accident radioactive cloud passes by. The total-population dose, under the conservative, assumed conditions, was determined to be 458,000 person-mrem. The average short-term dose to exposed workers would be approximately 102 mrem, the maximum dose to an individual worker should not exceed 200 mrem.

The short-term, total-population dose at INEL would be the greatest with a west-southwest plume direction. The total exposure would be 316,000 person-mrem to 3,222 persons. The exposed worker population would be between 10 and 30 kilometers (6 to 18 miles) from the release point and under the conservative, assumed conditions would receive doses of no more than 200 mrem. The average dose would be approximately 98 mrem.

4.12.2.5 On-Site Area Contamination. No ground contamination is expected as a result of normal operations. The maximum credible accident that resulted in the greatest consequence to the public and on-site workers is primarily an airborne gaseous release that would not result in significant ground contamination. Ground contamination from other accidents are anticipated to be localized within the facility boundary (dispersing over 100 acres or less). Estimates of bounding case evaluations of on-site ground contamination are presented in Appendix E. No significant off-site ground contamination is expected and material deposited off site would be far too diffuse to require cleanup. The impact of any radioactive material deposited off site is included in the consequence evaluations that estimate individual and population doses.

4.12.2.6 Transportation-Related Radiological Risk. Shipment of fissile radioactive materials is regulated by the requirements of 49 CFR 173, Subpart I. Transportation requirements for shipment of non-fissile radioactive material (also in 49 CFR 173, Subpart I) limit external radiation dose rates, radioactive material contamination levels, temperature, pressure and containment. The SNTP program would involve routine transportation of radioactive materials (uranium-bearing fuel and low-level waste) to and from the site, which would result in small radiological impacts to persons along the transportation routes. The direct radiation exposure resulting from normal transportation (i.e., no accidents), called the incident-free transportation risk, and the risk from accidents were analyzed separately. It was assumed that materials shipments would include the following: shipment of fuel material from Oak Ridge, Tennessee, to Lynchburg, Virginia; shipment of non-irradiated fuel specimens from Lynchburg to Albuquerque, New Mexico; and shipments of non-irradiated fuel elements and assemblies (up to a full GTA) from Lynchburg to NTS or INEL. The irradiated fuel elements selected for PIE are assumed to be shipped back to Lynchburg, Virginia, for analysis. Details of the transportation analysis are presented in Appendix E, Section 3.0.

The impacts of routine transportation of these materials and potential accidents were calculated using the RADTRAN 4 computer code (Neuhauser and Kanipe, 1991). Inputs to the code include the material properties characteristic of shipping containers, numbers of shipments, distances traveled, and population distributions for actual routes to and from the facilities involved. As stated in the discussion of the potential consequences of system operations and accidents, the system design is not sufficiently mature to support quantitative risk assessments. However, for this transportation analysis, appropriate data is available and estimates of risk (i.e., the quantification of the effects of both probability and consequence) are included in the discussion of transportation hazards.

Incident-Free Radiological Risk

The incident-free transportation risk would result from direct radiation exposure to persons sharing the roads with the vehicles transporting the materials, and those living near the roads or rest stops. Those dosages would be primarily minute external doses to a large number of motorists exposed for very short times. The analysis of the incident-free risk uses route-specific data, including total distance, adjacent population, and fraction of travel in each population-density zone (urban, suburban, or rural).

The population doses from incident-free transportation of SNTP program radioactive materials to NTS and INEL are calculated to be 112,000 person-mrem and 131,000 person-mrem, respectively. The potential increase in the incidence of radiation-induced health effects due to these total population doses would be approximately 0.09 additional latent cancer fatalities and 0.024 additional genetic effects from transportation to NTS and 0.1 additional latent cancer fatalities and 0.028 additional genetic effects from transportation to INEL.

Weather-related road closures in the region are not expected to affect the risk estimates. Effects due to weather would be kept to a minimum by considering actual and forecast road conditions and by not dispatching trucks either in bad weather or under poor forecast conditions. Restricting truck transport to good weather conditions would reduce the overall truck accident rate by only about 10 percent (NRC, 1977). Since accidents associated with travel in poor weather conditions are included in the DOT accident-rate data that were used in the risk analysis, the risk estimate is slightly conservative with respect to this parameter. The stop time is based on actual operational requirements for Safe Secure Transport (SST) shipments. A decreased stop time does result in a decrease in incident-free risk but has no effect on accident risk calculations.

Transportation Accident Impacts

The consequence of a severe accident involving the transport of enriched uranium are discussed in the Nuclear Regulatory Commission's final EIS on radioactive material transport (NRC, 1977). After evaluating the risks and consequences of radioactive material transport, including severe accidents, the NRC concluded that "the risks attendant to accidents involving radioactive material shipments are sufficiently small to allow continued shipments by all modes (e.g., truck, rail, air, barge)."

Minimal variation in accident rates for different regions supports the use of the national-average, combination-truck, accident rate for interstate highways, which is 0.00000031 (3.1×10^{-7}) accidents per kilometer (1.8 accidents per ten million miles). The RADTRAN 4 estimates of radiological risks from transportation accidents associated with SNTP program

shipments are 0.84 person-mrem for shipments to NTS and 0.93 person-mrem for shipments to INEL. These exposures may result in the projection of approximately 0.00000067 (6.7×10^{-7}) additional cancer fatalities and approximately 0.00000018 (1.8×10^{-7}) additional genetic disorders from NTS transportation, and up to 0.00000074 (7.4×10^{-7}) additional cancer fatalities and up to 0.00000020 (2.0×10^{-7}) additional genetic disorders from INEL transportation. For non-radiological transportation risks (e.g., traffic accidents), RADTRAN 4 analysis projects up to 0.20 fatalities due to shipments to NTS and 0.23 fatalities due to shipments to INEL.

4.12.3 Nonradiological Hazards

4.12.3.1 Construction. The design of the test facility has no known features that would increase worker hazards during construction. Site characterization would be conducted at both the SMTS and the CTF prior to construction, and any chemical and/or radiological contaminants present would be identified. Any remediation required to make the site safe for personnel and operations would be performed before PBR test facility construction activities could begin (see Section 4.5). Because construction activities would be performed in compliance with applicable worker safety codes (e.g., OSHA, National Electric Code, National Fire Protection Code, DOE), and because no occupational hazards, beyond those currently experienced during other construction activities at NTS or INEL (e.g., heavy equipment hazards, overhead and lifting hazards, trenching and shoring hazards and other construction hazards) have been identified, no significant non-radiological impacts, such as exposure to site contaminants, are expected to occur.

4.12.3.2 Normal Operations. The particle bed reactors and ETS use common gases (some as extremely low temperature [cryogenic] liquids) that can be hazardous in some situations. Because of their extremely low temperatures, liquid hydrogen (LH_2), liquid oxygen (LOX), and liquid nitrogen (LN_2) will damage or destroy animal and plant tissue on contact. Gaseous hydrogen, nitrogen, and helium in high enough concentrations can displace oxygen, causing asphyxiation. A high concentration of oxygen in the presence of flammable materials is a severe fire hazard; minimal to high concentrations of hydrogen in the presence of oxygen are extremely flammable and can be explosive. Despite these potential hazards, these materials have been used safely in commercial and research applications for decades without unreasonable danger.

Hydrogen Safety

Hydrogen is odorless and colorless as a gas or a liquid. It is not toxic, but is a simple asphyxiant in that it can reduce the oxygen concentration below that necessary to sustain life. The principal hazard associated with hydrogen arises from its extreme flammability range - from 4.0 to 72.4

percent in air. It ignites easily, burns rapidly with a nearly invisible flame, and can explode. Although it forms a combustible mixture very quickly, it is also very buoyant and disperses quickly.

Both liquid and gaseous hydrogen would be used in PBR validation testing and there would be several hydrogen storage vessels at the PBR test facility. The hydrogen system would be designed, maintained, and operated in compliance with the applicable National Fire Protection Association (NFPA), Compressed Gas Association (CGA), and American Society of Mechanical Engineers (ASME) standards to ensure its safety. Additional safety measures would include a shrapnel barrier to reduce the possibility that shrapnel generated by a nearby explosion would impact the hydrogen storage vessels, and the systems would be grounded to prevent static discharges. Generally, when a system ruptures, the proportion of combustible fuel in the spill is less than 10 percent of the total quantity spilled; so if a rupture should occur, only a portion of the theoretical maximum explosive potential would be available because high-energy explosions require a well-mixed oxygen-hydrogen environment. Also, although gaseous hydrogen forms a combustible mixture very quickly, it is also very buoyant and the hazard will therefore exist for a relatively shorter time than, for example, with a methane or gasoline [illegible] (McCarty et al., 1981). Although the deflagration (flame speed below the speed of sound) and/or detonation (flame speed above than the speed of sound) of hydrogen would cause a potential threat to the health and safety of on-site personnel, proper system design, storage, and handling would significantly reduce that danger.

If the storage systems are not properly purged following a handling operation, heat expansion of cold gases may cause system ruptures. This is compounded in the case of liquid hydrogen, where oxygen crystals can be formed in the fluid as a result of unpurged air in the system, resulting in a detonable mass. Because of these hazards, there must be provisions for venting in any potential fixed volume where cryogenic fluids might collect.

Large quantities of gaseous hydrogen have been used at industrial and rocket facilities for a number of years and a review of hydrogen safety literature regarding bulk storage and operations (Edeskuty, 1991) does not identify any extraordinary safety requirements for use and handling in an industrial environment.

Oxygen Safety

LOX is pale blue, gaseous oxygen is colorless, and both are odorless. Breathing an extremely high concentration of oxygen (60 percent or greater) can produce central nervous system effects. There are no workplace or emergency limits for oxygen (Air Products and Chemicals, 1989), although atmospheric concentrations greater than 25 percent are considered severe

fire hazards. Although oxygen itself is nonflammable, it vigorously supports and accelerates combustion of flammable materials. Normal oxygen content of the atmosphere at sea level is 20.8 percent by volume. Some materials that are considered to be noncombustible in air readily burn in the presence of pure oxygen. Guidelines set by the National Institute of Occupational Health and Safety recommend the oxygen content in air be maintained between 19.5 and 25 percent by volume. Environments with an atmospheric oxygen content of less than 19.5 percent are considered oxygen deficient and cannot support the requirements of human respiration.

Three potential dangers must be considered in relation to oxygen storage. Like LH_2, the extremely low temperatures of LOX will cause burns and tiss damage in the event of skin contact. Second, LOX readily supports combustion of oxidizable material, and is quickly absorbed by combustible materials (including clothing). In the presence of high concentrations of oxygen, many materials may quickly and violently ignite (Kirk-Othmer, 1966). Third, when LOX vaporizes at standard atmospheric conditions, the gas would take up 860 times as much space as the liquid. Should this happen in an unvented enclosed space, a high pressure explosion could occur (Kirk-Othmer, 1966). Leaks of oxygen from a storage system are especially dangerous in the presence of a highly combustible material such as hydrogen, which would also be stored at the ground test facility (National Fire Protection Association, 1986; Sax, 1984).

Similar to the hydrogen system, oxygen systems would be designed, maintained, and operated in compliance with applicable standards to ensure safety. The LOX storage area would be separated from the hydrogen storage area and, as with hydrogen, would be protected by a barrier designed to prevent impact to storage vessels from shrapnel. The pipes carrying the oxygen would also be insulated to prevent contact burns. Although the storage of oxygen would cause a potential threat to the health and safety of on-site personnel, locating the oxygen storage vessels away from the hydrogen storage area, along with proper storage and handling techniques, would minimize that danger.

Nitrogen and Helium Safety

Nitrogen and helium are odorless, colorless, nonflammable, and nontoxic. They are simple asphyxiants in that they can reduce the oxygen content to levels insufficient to support life. Helium is inert; it will not burn nor support combustion. Nitrogen is nearly inert; it neither burns nor supports combustion except in very high temperature/pressure conditions.

Storage vessels for helium and nitrogen would be built and protected in accordance with accepted industrial practices and would also have shrapnel barriers protecting them.

ETS Operations

Under normal operating conditions hydrogen exiting the ETS will be burned to prevent the accumulation of explosive concentrations of hydrogen in the ambient air. The plume which results from the flarestack will consist primarily of heated air and water vapor (produced when the hydrogen burns). Due to its heat content this plume will rise as it cools until it finally stabilizes at some distance downwind of the test station. An analysis of the plume was performed to determine the stabilization height and potential hazards to downwind air traffic.

Although for purposes of the radiological impact analysis plume rise was restricted to the height of the inversion layer to maximize the potential radiological impacts, in practice the buoyant rise of the heated plume (the same lift effect observed with hot-air balloons) would be sufficient to penetrate such low-level inversions. The primary meteorological parameters which affect plume rise and stabilization are:

1) Vertical Potential Temperature Gradient (VTG) is the rate at which air temperature drops with increasing altitude. VTG affects the speed with which a plume rises.

2) Horizontal and vertical plume dispersion, which determines the rate at which the plume expands in size due to air turbulence and mixing. Plume dispersion acts to cool the plume's temperature until it finally reaches ambient conditions.

In analyzing the ETS plume, dispersion values were selected to correspond to dispersion associated with model weather conditions (see Table 4.12-1). Plume stabilization was calculated for two VTG cases. The first case uses a VTG value which corresponds to that likely to be encountered during model weather conditions. For this case a plume stabilization height of approximately 2,780 meters (9,100 feet) was identified, beginning at about 15 kilometers (9.3 miles) downwind of the stack. In the second case the reasonable VTG value which maximizes plume rise was used. For this case a plume stabilization height of approximately 6,000 meters (19,700 feet) was identified, beginning at about 32 kilometers (20 miles) downwind of the stack.

For both cases the upper edge of the plume would extend above the stabilization height, and the plume would continue to expand as it traveled further downwind, until it eventually is dissipated by atmospheric turbulence. In both cases however, minimal hazards are presented to downwind air traffic since beyond a downwind distance of 1-2 kilometers (0.6 to 1.2 miles) the plume is sufficiently cooled that aircraft can easily pass through without incident.

At NTS, flight restrictions will preclude aircraft entering the plume in this region. At INEL, only flights below 1,600 feet are restricted, which may allow limited access to areas where there could be additional turbulence due to the plume (see Section 4.4). No other hazards have been identified in association with downwind plume rise.

4.12.3.3 Potential Accidents

Explosion in the Cryogenics Storage Facilities. The most serious potential accident in the cryogenic materials storage area would be a detonation following a release of all the LH_2 from a large storage vessel. The ranges of some of the effects of such an explosion, assuming flat terrain and no shielding from the blast, are shown in Table 4.12-10. Such a detonation is very unlikely; it could occur only as the result of a series of unlikely system failures. The blast wave, heat, and flying debris would undoubtedly cause extensive damage to other facilities in the area, possibly including storage vessels for LOX, LN_2 or helium. Hydrogen, oxygen and helium do not, by themselves, create highly toxic combustion products, but the addition of LN_2 to a fire or explosion could produce toxic nitrogen oxides. Combustion of other materials in the vicinity could produce some toxic byproducts.

Table 4.12-10. Damage Distances from a Single Storage Vessel Accident

Threshold	Distance (kilometers)
1% Window Breakage	19.5
Safe Inhabited Building Distance	1.5
Safe Public Road Distance	0.825
1% Ear Drum Rupture	0.525
1% Death	0.2

Effluent Treatment System. There are three potential safety hazards associated with the ETS used to treat the exhaust from PIPET and GTA testing. First, air may enter the system, mix with hydrogen, and cause deflagration and/or detonation; hydrogen deflagration and/or detonation within, or adjacent to, the ETS may cause serious damage and/or loss of life. Second, leaks may develop, allowing hydrogen to escape into the atmosphere where ignition and subsequent deflagration and/or detonation could also occur. Third, the flare may extinguish, causing a safety hazard as the unburned hydrogen accumulates and creates an explosive atmosphere external to the system.

To prevent infiltration of air into the system, a complete purge using gaseous helium would be accomplished prior to the start of a test operation. This purge would ensure that a helium atmosphere displaces any oxygen in

the system. The system would also be operated at positive pressure to prevent reinfiltration of oxygen.

Monitoring would be accomplished during test operations to detect any hydrogen leaks. Prior to test operations, the system would be thoroughly inspected to detect any possible points where leakage may occur, with special attention given to valves, pipe joints and other pipe-fit locations.

Hydrogen Flare Stack. For normal operation of the flare stack, air must be excluded. If air is allowed in, a fire or explosion of the hydrogen/oxygen mixture is very likely. However, the relatively small amount of such a mixture that could accumulate in the stack would produce an explosion much smaller than a storage vessel explosion. It could damage the stack, but during normal operations no workers would be within the potential human injury distance of such an explosion.

Beryllium Release. The reactors may contain some beryllium metal. In the event of a catastrophic failure of the reactor core, some of it could be released as beryllium oxide, which is toxic if inhaled. Although no credible accident has been identified that would release a substantial amount of the beryllium in a form that could be inhaled, the analysis performed assumed that all beryllium was released as beryllium oxide. This analysis includes consideration of hydrogen fire and explosion, which was found to be insufficiently energetic to mobilize significant quantities of beryllium. The details of the analysis are described in Section 6.0 of Appendix E. The results of the analysis indicate that even in the event of total release, the exposure to any individual would not exceed 0.0003 milligram (mg), which is less than two percent of the OSHA daily exposure limit of 0.0173 milligram.

4.12.3.4 Transportation of Cryogenic Materials

Cryogenic liquids would be obtained from commercial sources and transported to NTS or INEL by railcar or tanker truck. Transportation of cryogenic materials is a routine commercial operation. Normal (i.e., no accidents) transportation of cryogenic materials involves no hazard to the public.

However, LH_2, LN_2, and LOX would present moderate to severe hazard potentials in the event of a vehicle accident during their transportation between the manufacturing plant and NTS or INEL. All three are cryogenic liquids that could kill or damage any living tissue on contact. Upon evaporating, LH_2 and LN_2 would displace air in the immediate vicinity of a spill, causing an asphyxiation hazard. LOX would increase the risk and severity of fires. LH_2 presents the greatest potential hazard because any hydrogen that escaped from the tank would mix with air, creating a fire/explosion hazard.

An analysis of the LH_2 fire/explosion hazard is presented as the maximum-consequence transportation accident. The analysis was performed using the Automated Resource for Chemical Hazard Incident Evaluation (ARCHIE) model. The ARCHIE model is used by communities with emergency planning responsibilities to evaluate accident consequences; it is used here to compare the consequences of slow and fast (total) releases for rail and truck transport. For this analysis, slow release is considered to be 100 gallons per minute. At this rate, it will take more than 30 minutes for the entire tank contents to be released. A fast release is one in which the entire contents are released in the first five minutes after the accident.

Three accident scenarios were analyzed:

- Pool fire: a released pool of LH_2 is ignited and burns across the pool surface

- Uncontained vapor cloud explosion: the hydrogen vapor cloud above a pool of LH_2 burns with a flame propagation speed greater than the speed of sound

- Fireball: The hydrogen vapor cloud above a pool of LH_2 burns with a flame propagation speed less than the speed of sound

A summary of the results of the analysis is presented in Table 4.12-11. The *numbers reported are zones of effect, expressed* as the *distance from the* center of the fire or detonation. The zones of effect are generally larger for releases from railcars because a railcar would carry more LH_2 than a tanker truck. However, rail is considered the safer way to transport LH_2 because the probability of a railcar spill is much smaller.

4.12.3.5 Site-Specific Hazards

SMTS

No additional health and safety hazards have been identified that are unique to the SMTS.

CTF

In addition to the hazards shared with the SMTS, the CTF presents an additional hazard related to the use of the existing containment structure. The use of this structure for testing purposes may allow the build-up of hydrogen inside the facility during test operations. Following test completion, venting of the structure would be required before personnel could enter. This would prevent the potential for explosion due to ignition of explosive concentrations of hydrogen, or asphyxiation due to low oxygen levels. Because the use of the containment structure could threaten the

Table 4.12-11. Comparative Data on the Consequences of Four Accident Scenarios

	Tanker Truck Spill (Slow Release) (feet)	Tanker Truck Spill (Total Release) (feet)	Railcar Spill (Slow Release) (feet)	Railcar Spill (Total Release) (feet)
Pool Fire				
• Fatality Zone	31	88	44	315
• Injury Zone	45	126	63	451
Unconfined Vapor Cloud Explosion[a]				
• Fatality Zone	26	77	31	140
• Injury Zone	142	410	162	742
• Property Damage Zone[b]	381	1,097	433	1,990
Fireball				
• Fatality Zone	218	218	218	218
• Injury Zone	466	466	466	466

Notes: (a) All distances are radii except for the vapor cloud explosion. The distance values for the vapor cloud explosion are in distance from the explosion, which can occur anywhere within the ground area passed over by the cloud or plume.

(b) Property damage defined as some damage to home ceilings; 10 percent window breakage.

physical well-being of workers, its use may have a moderate impact on safety.

4.12.4 Mitigation Measures

During normal operations and radioactive material transport, no mitigation measures would be required (except hydrogen plume avoidance at INEL; see Section 4.4.2.2) since impacts would be below regulatory thresholds, and would be very small relative to the existing natural radiation environment. In the event of an accident during reactor operation, several measures could be taken to reduce impacts, including:

- Isolate affected areas downwind of the SMTS or the CTF to limit exposure to personnel and the public. This can be accomplished through road closure and/or evacuation of populations in accordance with pre-established accident response plans.

- Restrict use of land contaminated as a result of an accidental release. Restrictions could include limitations on allowable activities (e.g., no grazing or agriculture). Restrictions would reduce the long-term dose resulting from resuspension inhalation, groundshine, and ingestion of contaminated food products. They would also act to prevent migration of contamination to non-restricted and unaffected areas.

- Decontaminate to reduce the need for long-term land use restriction.

Mitigation of effects due to transportation accidents would be similar to those cited above. However, because affected areas would be much smaller, immediate evacuation followed by decontamination efforts would be favored. This would reduce impacts resulting from accidents to below evaluated levels.

4.12.5 No-Action Alternative

Since no activities or uses of radiological, hazardous, or cryogenic materials would occur with the No-Action Alternative, no health and safety-related impacts would occur at either of the SNTP alternative sites or along any transportation routes.

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5.0 CONSULTATION AND COORDINATION

Federal and state agencies that were contacted during the course of preparing this environmental impact statement are listed below.

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U.S. Department of Energy
U.S. Department of Energy, Idaho Field Office
U.S. Department of Energy, Nevada Field Office
U.S. Department of the Interior, Fish and Wildlife Service
U.S. Department of the Interior, National Park Service

STATE AGENCIES

Nevada Bureau of Air Quality
Nevada Fish and Game Department
Nevada Wildlife Department
State Office of Historic Preservation (Nevada)
State Office of Historic Preservation (Idaho)

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8.0 INDEX

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9.0 PUBLIC COMMENTS AND RESPONSES

INTRODUCTION

The Air Force has complied with the National Environmental Policy Act (NEPA) mandate of public participation in the environmental impact analysis process primarily in two ways. The subject Draft Environmental Impact Statement (DEIS) was made available for public review and comment in August-October 1992. In addition, four public hearings were held at which the Air Force presented the findings of the DEIS for the Space Nuclear Thermal Propulsion (SNTP) Program and invited public comment. The meetings were held at the following locations:

- Las Vegas, Nevada on 8 September 1992
- St. George, Utah on 10 September 1992
- Salt Lake City, Utah on 15 September 1992
- Idaho Falls, Idaho on 17 September 1992

Public comments received both verbally at the public meeting and in writing during the response period have been reviewed and are addressed by the Air Force in this section.

ORGANIZATION

This Public Comment and Response section is organized into several subsections, as follows:

- This introduction, which describes the process, organization, and approach taken in addressing public comments
- A consolidated comment-response document
- An index of commentors
- Transcript of the public hearings
- Photocopies of all written comments received.

These sections are described below.

Comments received that are similar in nature or address similar concerns have been consolidated to focus on the issue of concern, and a response is provided that addresses all of the similar comments. Some comments simply state a fact or opinion, for example, "Idaho National Engineering Laboratory (INEL) has over 40 years of experience with nuclear reactors."

Such comments, although appreciated, do not require a specific response and are not called out herein. All comments will be passed on to the decision-maker. The comments and responses that are discussed are grouped by area of concern, as follows:

1.0 Policy
2.0 Purpose of and Need for the Proposed Action
3.0 Alternatives Including the Proposed Action
4.0 Local Community
5.0 Land Use
6.0 Hazardous Materials And Hazardous Waste Management
7.0 Air Quality
8.0 Biological Resources
9.0 Cultural Resources
10.0 Geology and Soils
11.0 Water Resources
12.0 Health and Safety
13.0 General

Within each area, each consolidated comment-response is numbered sequentially. For example, under 9.0 Cultural Resources, individual comments-responses are numbered 9.1, 9.2, etc. At the end of each numbered comment is a set of numbers that refer to the specific comment in the documents received that were combined into that consolidated comment. The numbers of the individual comments are indicated in parentheses, e.g. (1-14, 7-2, 40-6, 108-5). Comment 1-14, for example, refers to document 1, comment number 14. A reader who wishes to read the specific comment(s) received may turn to the photocopies of the documents included in this section. Below each comment number is the number of the consolidated comment in which the specific comment has been encompassed, e.g. 6.1. Thus, the reader may reference back and forth between the consolidated comments-responses and the specific comment documents as they were received. It should be noted that comments of a general nature (i.e., those addressed in Section 13) have been designated by letters (e.g. 3-B) for editing purposes.

It should be further noted that some comments in the documents received are not included in the consolidated comment-response document. These are comments to which no response is required, as explained above.

Finally, it should be emphasized that not only have responses to EIS comments been addressed in this comment-response section, as explained, but the text of the EIS itself has also been revised, as appropriate, to reflect the concerns expressed in the public comments.

The index of commentors (Page 9-63) includes the name of the commentor, the identifying document number that has been assigned to it, and the page

number in this chapter on which the photocopy of the document is presented.

1.0 POLICY

1.1 Comment: Programmatic EISs are being done for Nevada Test Site (NTS) and INEL on the remediation and reconfiguration of the sites. The SNTP EIS should be postponed until after completion of the programmatic EISs. The SNTP wastes should be discussed in context of these programmatic EISs. Installation-wide activities for these EISs should be considered as cumulative impacts. (1-17, 7-2, 107-13, 107-20, 118-4, 171-2, 171-16)

Response: The programmatic EISs (PEIS) referred to (Integrated Environmental Restoration and Waste Management [ER & WM] Program, and Reconfiguration of the Nuclear Weapons Complex) are documents with broad scope covering numerous Department of Energy (DOE) installations. The ER & WM PEIS will describe numerous alternatives for remediation activities, waste treatment, storage, and disposal locations and procedures, and related activities at DOE installations. The Reconfiguration PEIS will analyze numerous alternatives, including one alternative to move several facilities to INEL. Brief descriptions of the actions being studied and potential hazardous waste cumulative impacts have been added to Sections 2.7 and 4.5, respectively. These actions may cause modifications to waste management practices; however, the capability to handle wastes generated by the SNTP program would still exist. In accordance with CEQ Regulations (40 CFR 1506.1 (c)), the SNTP program has been analyzed separately in this EIS, and would not prejudice the decisions to be made on those programs. Therefore, the NEPA process for the SNTP program may proceed on its own schedule.

1.2 Comment: The nuclear rocket portion of the program should be analyzed in this EIS. The greater scope of the EIS should include the probability and resultant impacts of an accident during launch. Comment includes a discussion of the Consequence I-type accident (analyzed in the DEIS), and how these types of accidents would be similar to a rocket launch accident. (2-9, 3-24, 3-25, 171-3, 118-30, 118-57, 199-3)

Response: The Air Force proposal involves developing and validating the Particle Bed Reactor (PBR) technology. If the PBR technology itself is proven, the Air Force may then propose specific potential follow-on activities. It would be premature to attempt to evaluate environmental impacts of activities as yet unplanned, or of a system yet to be characterized. As stated in Section 1.4, should the

technology be refined to such a point, appropriate environmental impact analyses would be carried out to support those types of decisions.

1.3 Comment: Scope of the EIS should be expanded to include analysis of component testing, prior to testing of multiple assemblies (which are covered in the EIS). The project should also include component fabrication phases and post-operational (i.e., post-PBR validation) research. (4-1, 17-5, 54-1)

Response: Component fabrication and testing would be required to be carried out at contractor facilities and national laboratories, not at the PBR validation test site. These activities fall within the existing operational characteristics of these facilities, the environmental impacts of which have been analyzed in existing environmental documentation.

1.4 Comment: The EIS should evaluate an alternative to perform needed rocket launches using alternative propellants, such as solid rocket motors used for the Trident II missiles, and/or replacing nuclear warheads with satellites and thereby using existing, un-needed rockets. (3-13)

Response: The proposal in this EIS is a technology development program, not selection of a particular space launch system. Therefore, study of alternative propellants and missile use is not appropriate.

1.5 Comment: Testing at Sandia National Laboratories needs to be included in the environmental analysis. (118-12)

Response: New activities performed at Sandia National Laboratories would be within the bounds of existing environmental documentation.

1.6 Comment: Expand the scope of the study to include evaluating the suitability of the site for all DOE and National Aeronautics and Space Administration (NASA) space propulsion programs, as well as future international cooperation in such efforts. (36-2, 103-2)

Response: The proposal in this EIS is a technology development program, not selection of space propulsion programs. Therefore, study of other propulsion programs, and the suitability of the PBR validation test site(s) for supporting these programs, is not appropriate.

1.7 Comment: The DEIS does not contain an appendix with the Scoping comments. The DEIS cannot be properly reviewed without these comments. (1-11)

Response: There is no obligation to formally present or respond to comments received during the scoping period. Scoping is a part of the public process with the goal of gathering information on environmental issues and to guide the development of the EIS. Scoping was accomplished from March 13, 1992 through May 15, 1992, with four public meetings conducted in Nevada, Utah, and Idaho. In addition to these meetings, scoping was developed by means of communication with governmental/regulatory agencies, literature searches, and conversations with various individuals. Environmental issues identified during scoping included nuclear safety, transportation safety, hazardous materials handling, and hazardous and radioactive waste disposal. These issues have been addressed in detail in the DEIS, which can be reviewed as a stand-alone document.

1.8 Comment: The public comment period for the DEIS should be extended; the accelerated schedule for this document does not allow for proper review. Copies of the DEIS were not made available. Notice of the DEIS and public hearings was insufficient. (1-10, 2-11, 3-22, 24-1, 199-1)

Response: The public comment period, 21 August to 5 October, 1992, was not formally extended. This 45-day period, which is specified by Council of Environmental Quality (CEQ) regulations (Section 1506.10), is believed to be adequate to allow for review by interested parties. However, the schedule for the FEIS was revised, thereby allowing additional time for comments received to be incorporated into the document. All comments, including those received after 5 October, have been incorporated. During the comment period, four public hearings were conducted in Las Vegas, Nevada; St. George and Salt Lake City, Utah; and Idaho Falls, Idaho, with approximately 140 statements given. The DEIS was mailed to approximately 400 interested individuals, elected officials, federal, state, and local agencies, and libraries in the affected areas.

Notice of availability of the DEIS was provided to local newspapers, radio and television stations, and was published in the Federal Register. Everyone who requested a copy of the DEIS was provided a copy. Procedures for requesting copies were discussed at both scoping meetings and public hearings. Those who did not request a copy could review the DEIS at local libraries.

Notice of public hearings was also provided to local newspapers, radio and television stations, in addition to being listed in the DEIS itself.

1.9 Comment: Additional public hearings of the DEIS were requested for Twin Falls, Boise, and Moscow, Idaho. (118-1)

Response: Public hearings were conducted in population centers within the region affected or potentially affected by the proposed action, which were identified as Las Vegas, Nevada, and Idaho Falls, Idaho. In addition, during scoping, it was determined there were large enough numbers of people in Salt Lake City and St. George, Utah who were interested and would attend, to justify holding additional hearings at those locations. The public hearing in Idaho was held in the nearest city to INEL (Idaho Falls, approximately 40 radial miles from the CTF). The locations identified by the request are much further (Twin Falls-110 radial miles, Boise-160 radial miles, Moscow-270 radial miles); these locations are even farther when considering road miles. In addition, comments were received from locations other than Idaho Falls (e.g., the Idaho Governor's Office in Boise); therefore, additional hearings do not appear to be necessary.

1.10 Comment: Does the SNTP program include examination of previous, similar tests? Is the information from previous programs useful in identifying impacts? (2-34)

Response: The SNTP program, as a fundamental research and development activity, has reviewed all previous related efforts and incorporated these results where appropriate.

1.11 Comment: Indemnification in case of an accident is not discussed. Government liability limits need to be discussed. (118-5)

Response: Neither financial protection nor an indemnity agreement is required by the Price-Anderson Act for this project. In the event of an accident, however, one who has suffered property damage or personal injury may be able to bring a claim against the United States under Federal Tort Claims Act (28 USC Sect. 1346(b)).

1.12 Comment: The DEIS identified 93 percent U-235 as the fuel, but leaves the door open to "other similar particle designs that may have high performance characteristics." If other fuels are possible, they need to be identified and analyzed. Definitive and exclusionary language on fuel type to which the Departments can be held must be in the final document. (118-8)

Response: The proposed fuel design is based on the use of uranium fuel enriched to 93 percent U-235. Although the fission product inventory would vary somewhat with different fuels, the potential radiological releases would be very similar. Therefore, the analysis based on U-235 adequately represents the environmental impacts that could arise form the use of other, similar fuels.

1.13 Comment: Vague text ("cryogenic absorption beds and cold traps are under consideration") shows a lack of commitment and uncertainty. Be more specific. A description of the system used to scrub out radionuclides from effluent was requested (i.e., including scrubbers, bag house, electrostatic precipitators, etc.). Additional questions on the design of the effluent treatment system (ETS), its ability to perform to standards, validation, etc., were also provided (2-32, 17-9, 118-56)

Response: Conceptual designs of ETS that provide for the optimum removal of contaminants from the exhaust stream continue to be evaluated. The validity of the analysis in the EIS depends on the design efficiencies of the ETS and resulting release quantities, not the exact design of the system. If the final design would have different release quantities than those identified in the EIS, additional analysis and environmental documentation would be required.

1.14 Comment: Uncertainty of analysis is not addressed in the DEIS. (118-29)

Response: Rather than report expected values and potential uncertainties, the EIS presents the most conservative, credible estimates of impacts.

1.15 Comment: There is no discussion of the history of nuclear testing at the NTS (3-17)

Response: A brief description of nuclear activities at NTS is provided in Section 3.1.1.1.

1.16 Comment: The EIS presents a good summary of previous nuclear reactor testing activities at NTS, but does not provide equal detail of INEL activities. (4-8)

Response: A brief description of nuclear activities at INEL is provided in Section 3.1.1.2; the text has been expanded to provide similar level of detail as presented for NTS.

1.17 Comment: The DEIS does not present a fair or complete comparison between the two alternative sites. For example, the list of agencies

consulted shows four Nevada state agencies were consulted, and only one Idaho agency was consulted. Also, there were more authors/contributors from Nevada than from Idaho. (4-7)

Response: The two alternative sites were evaluated at an equal level of detail, as required by NEPA. To respond specifically to the consultation concern, the State Office of Historic Preservation was contacted in both states in support of compliance with the National Historic Preservation Act. Potential concerns with threatened and endangered species were discussed with the U.S. Fish and Wildlife Service for both sites. The Nevada state agencies were contacted to collect certain data for the analysis process; similar data for the INEL site were collected from the INEL itself. Therefore, additional data collection from those agencies in Idaho was not pursued. The number of authors/contributors from both sites was approximately the same.

1.18 Comment: The document contains confusing terms and phrases; for example, using "bounding energetic accident" to describe a hydrogen explosion. Another example is "bounding case conditions provided for accident analysis conducted by Program Safety." The EIS obscures the facts about the potential danger to the public from SNTP. The section on selection of bounding case scenarios is difficult to understand. Rewrite the document to be more clear. (1-16, 2-7, 2-19, 17-13, 198-3)

Response: A concerted effort has been made in the writing of this document to write in plain English, to be understood by the general public. However, some of the subjects dealing with chemical and nuclear safety are, by their nature, very technically intensive. Where such subjects warrant a more detailed, scientific presentation, they are given in appendices. Portions of the Health and Safety analysis discussions (Section 4.12) have been revised and edited to enhance clarity.

1.19 Comment: It is not clear who is the main proponent of this program (the Air Force, NASA, Phillips Laboratory, etc.). (3-23)

Response: As stated in the EIS, the proponent of this program is the U.S. Air Force. The project is being studied and considered for implementation by the Phillips Laboratory, which is a unit within the Air Force. Because the two alternative test locations are on DOE facilities, the DOE is a cooperating agency on the environmental impact analysis process.

1.20 Comment: Why is the Air Force the proponent of this action rather than NASA? What is the involvement of NASA? (2-40, 3-2, 107-2, 167-4, 170-3)

Response: The Air Force is the proponent of the SNTP program because the program is a Department of Defense (DOD) program. The DOD has decided to pursue this program. NASA is maintaining an awareness of the SNTP program.

1.21 Comment: Federal law states that the proponent must consult and coordinate with other governmental entities; local governments were not consulted in this EIS process. (2-44, 22-1)

Response: A good faith effort was made through the scoping and DEIS review process to solicit environmental concerns and issues. Availability of the DEIS was widely publicized; approximately 175 copies were provided to federal, state, and local elected officials as well as federal, state, and local agencies. As a result, numerous comments on issues have been received from the public and all levels of government.

1.22 Comment: The DEIS does not discuss essential factors needed for making an informed siting decision (40 CFR 1502.29[b]). (170-18)

Response: The listed citation (40 CFR 1502.29[b]) does not exist in the CEQ regulations. Both sites are considered to be part of the proposed action; descriptive detail and potential impacts from proceeding with the proposed action at either site are provided in the EIS so that they can be compared to each other and against the no-action alternative (40 CFR 1502.14 (b) and 40 CFR 1502.16).

1.23 Comment: What happens to the EIS if the project status parameters that have been described which made the EIS acceptable now are found to be different? (2-48)

Response: In accordance with the NEPA requirements, new impact analysis would be performed for these aspects of the program that changed, total program impacts would be reviewed, and new NEPA documentation (such as a Supplemental EIS) would be developed. Based on this analysis, a new or revised decision would be made on whether, where, and/or how to proceed with the program.

1.24 Comment: Suggest designing facilities so that they can be used by both military and civilian nuclear propulsion efforts. Specifically, the ETS is not feasible for relatively long, full power tests anticipated in civilian test programs. Water cooling should be explored at sites where water is available. (198-2)

Response: As indicated in the current environmental documentation, the proposed facilities will include as much flexibility as possible to enhance their adaptability to future non-military efforts. Water cooling is a future option which could be supported at either of the alternative testing locations but may require additional environmental evaluations.

2.0 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

2.1 Comment: Expand/improve the discussion of the purpose of the program. The Purpose and Need discussions are insufficient. The purpose and need of the subsequent nuclear rocket is not clear, and because of this, the need for the SNTP program is not clear. What are the consequences of not performing the tests? Is national defense a consideration for need? If so, explain. There is no national policy for space nuclear propulsion; therefore this project cannot proceed. (1-2, 1-7, 1-9, 1-23, 2-2, 2-3, 2-6, 2-12, 2-13, 2-21, 2-24, 2-30, 2-35, 2-37, 2-41, 2-43, 3-1, 3-15, 3-20, 107-1, 107-18, 108-1, 108-3, 118-2, 119-1, 167-1, 170-1, 171-1, 198-4, 198-5, 198-6, 199-2)

Response: The purpose and need discussion sections discuss the Air Force's purpose in context of its basic mission, and the need for performing PBR validation testing in context of fulfilling that purpose. Additional text has been added to Sections 1.2 and 1.3 to clarify. Also refer to comment 2.2.

The issue of whether there is a national policy supporting space nuclear propulsion and whether the project could proceed in the absence of such a policy are not issues that are appropriate for discussion in an EIS.

2.2 Comment: Clarify the discussion of the SNTP program in context of how SNTP fits into a nuclear rocket program; clarify that the rocket testing is not included in this EIS. Include specific uses of nuclear rockets (e.g., low earth orbit versus high earth orbit, missions to Mars, etc.) that would result from SNTP. What types and how many tests (e.g., number and duration of flight rating tests) would be required for the rocket program? Include non-military applications that could occur. What are the possibilities for spin-off industries? Will the ground test data be used to extrapolate to flight conditions? (1-3, 1-4, 2-14, 2-15, 2-24, 2-28, 3-3, 16-2, 17-1, 17-4, 17-7, 17-14, 64-1, 109-7, 170-2, 198-7)

Response: The proposal in this EIS is a technology development program, not selection of nuclear rocket launch programs. The need

and purpose sections (Sections 1.2 and 1.3) have been edited for clarity.

2.3 Comment: A statement in the DEIS seems to imply that a classified EIS on this program exists. Clarify. (17-8)

Response: There is no classified EIS for the SNTP program. Some of the data for the SNTP EIS were taken from a declassified EIS that was developed for a previous, similar program.

2.4 Comment: The FEIS should include background information on why SNTP would be considered preferable to other rocket propulsion technologies. The DEIS does not explain the rationale for pursuing this technology in comparison to the No-Action Alternative. The FEIS should provide additional background on the historical development of nuclear powered rockets and should explain the rationale for considering nuclear thermal propulsion technology as an alternative to other propulsion technologies. A summary of other propulsion technologies which can be reasonably assumed for future use should be included in the No-Action Alternative. (201-1, 201-4)

Response: The proposed action associated with the SNTP program is the development and validation of particle bed reactor technology which is potentially applicable to advanced nuclear thermal propulsion systems. In the event that this technology should eventually be proposed for a specific application, all competing technologies for that application would be analyzed and appropriate environmental documentation would be prepared.

2.5 Comment: Among the overall purposes of the action, the DEIS cites reducing costs of military operations and development of "less expensive and more operationally effective access to space". No documentation of potential cost effectiveness of the proposed technology is provided. The FEIS should provide information on projected costs of proposal and explain how cost of nuclear thermal propulsion compares with other propulsion options. (201-5)

Response: The projected cost of this proposed action has no direct relationship to the future cost of a nuclear thermal propulsion engine. It is the costs associated with the final nuclear thermal engine that would provide an appropriate comparison to the cost of any alternative propulsion systems. While one of the objectives of the proposed action is to develop more economical access to space, development of this particular technology is requisite to accomplishing this stated goal.

3.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 Comment: How many other locations not analyzed in the DEIS would be suitable for the SNTP program? Why are those sites not considered in the DEIS? Other potentially suitable sites were suggested. (1-18, 17-12, 198-1)

Response: Based on the Site Narrowing Report (summarized in Appendix F of the EIS), three potentially suitable sites were identified (SMTS at NTS, and CTF and Quest at INEL). The Quest site was eliminated due to the presence of cultural resources. Therefore, the two sites analyzed in the EIS are considered to be the only reasonable alternatives.

3.2 Comment: Questions/suggestions on whether testing the PBR on uninhabited islands, other areas of the world with less population, or in inactive nuclear facilities in the former Soviet Union were considered as alternatives. (2-4, 2-8, 2-22, 2-29, 2-39)

Response: Comment 3.1 asked if other sites are reasonable for the SNTP program; this comment suggests other sites off of the continental United States. Performing this test program in foreign territory is not practical or reasonable due to additional coordination requirements (State Department coordination and potential compliance with foreign laws and regulations) as well as security issues that would arise from performing this program on foreign soil. Uninhabited islands, etc. were not considered because two exclusionary criteria (summarized in Appendix F) were the use of existing federally owned land and the presence of similar operations. Acquisition of land or use of non-federal land is not practical. The presence of similar operations is important for numerous reasons, including availability of trained work force, technical interaction with similar programs (useful in problem solving and idea-generating activities), and availability of existing permits/facilities for radioactive/hazardous materials and waste transportation, storage, and/or disposal. Also, other environmental impacts would be introduced if the test site were located on an island (e.g., exposures to marine mammals).

3.3 Comment: Why is neither of the alternative sites chosen as the preferred alternative? The DEIS fails to provide the type of information needed to support an informed siting decision. (107-3, 107-4, 170-4)

Response: Section 2.6, Preferred Alternative, has been added to the FEIS to discuss this subject.

3.4 Comment: The exact schedule of the SNTP test program was requested. The start year and year of completion were specifically requested. (2-27)

Response: As stated in the EIS, the SNTP program is projected to span up to ten years. However, the exact start and end dates cannot be predicted with certainty due to numerous issues, including funding, completion of facility and test article designs, and completion of the SAR. Likewise, the exact dates on which tests would be performed cannot be predicted with certainty because the execution of a particular test would depend, in part, on meteorological conditions and the results of previous tests.

3.5 Comment: The number of construction and operations employees used in environmental analysis seems very low. Should the numbers of employees (and related analyses) be revised to indicate more employees for construction and operations? (1-8, 1-20, 5-2)

Response: The required construction force was estimated by a construction contractor with experience in this type of activity. The estimated operations force is consistent with reactor-related research and development activities.

3.6 Comment: Request information on how rail transportation would be used (if at all) in the transport of liquid hydrogen, etc. If used, what routes would be used? What impact, if any, do towns/cities along truck/rail routes have in permitting/impeding materials in transit to their locations? (115-1)

Response: Mode of transport and routes used for liquid hydrogen and other similar materials would be selected by the supplier, based on cost, efficiency, scheduling, etc. If rail were used, the material would need to be piggybacked or transferred from rail car to truck at some point, because neither alternative site has a rail spur accessing the site. The program would not build new rail spurs for this activity.

The comparative safety of transporting hazardous materials (e.g., liquid hydrogen) on rail versus roads is discussed in Section 4.12.3.4. Routes would be established by the supplier and contracted transportation company (e.g., railroad company) based on cost and Department of Transportation regulations. Hazardous materials such as cryogenic liquids are routinely transported throughout the United States on a daily basis using both rail and road, and accidents, although they do occasionally occur, are not common.

Interstate transportation of hazardous materials is governed by Department of Transportation regulations; municipalities do not have jurisdiction over interstate travel. The supplier of liquid hydrogen, etc., would be required to comply with all applicable state and local regulations when on state or local roads.

3.7 Comment: Will the tests be conducted when the winds are blowing toward southern Utah? Can the tests be performed with wind blowing in other directions? (3-18, 20-1, 27-1)

Response: Nothing in the program design specifically precludes conducting tests when the winds are blowing toward southern Utah (or any other direction) from either site alternative. The EIS (Table 4.12-1) indicates an acceptable combination of weather conditions for a test to take place at NTS or at INEL. These conditions were used in modeling radiological impacts to the public for normal testing operations. For the NTS, a wind direction blowing toward the north-northeast was assumed and the resulting radiation dose to the maximally exposed individual was shown to be well below the regulatory limits. Model results would be overlain on a regional map to define allowable meteorological conditions for testing. However, under no circumstances would tests be permitted to occur during conditions where the potential exists for impacts to exceed those presented in the EIS.

3.8 Comment: Will radioactive materials be transported outside the testing facility? What routes will be used? How often will it be transported? In what amounts will it be transported? How does the transportation compare between NTS and INEL? A concern is accidents on the highway. (3-19, 20-2, 39-1)

Response: These issues are addressed in the EIS. Section 4.12.2.2 discusses transportation of radiological materials under normal conditions; Section 4.12.4 discusses transportation accident scenarios. A description of the modeling performed to support transportation impact analysis is presented in Section 3.0 of Appendix E. Tables E-20 and E-21 show the number and types of trips as well as representative routes. Specific details (such as routes to be used, etc.) have not been defined; they would, however, comply with all applicable packaging, transporting, and routing regulations.

3.9 Comment: With the large amount of liquid hydrogen to be delivered to the PBR facility, it seems that transporting these materials on a dirt road up the side of a mountain to the Saddle Mountain Test Station (SMTS) at NTS would have safety, risk, and cost impacts. Is a paved road required? (35-1)

Response: Additional text has been added to the EIS in response to the comment. See Section 2.3.1.2, 3.4.1.1, and 4.4.1.1.

3.10 Comment: A commitment to quality assurance of the fuel particles must be included in the project description. Quality control for fuel manufacturing must be made available for inspection. (118-10, 171-5)

Response: Comment noted. The SNTP Program fuel development activities are being performed in strict compliance with a quality program that meets the requirement of "Quality Assurance Program Requirements for Nuclear Power Plants" NQA-1-1989 and DOE Order 5700.6C "Quality Assurance". The quality records on the fuel fabrication process are a part of the contractual documentation provided by the fuel vendor and are maintained accordingly. The environmental impact analysis has shown that the impact to the public is not significant. Although these record are available to those with a need to know, they are not needed to evaluate either the safety of the proposed test program or the environmental impacts from fuel failure.

3.11 Comment: Anticipated temperatures for the reactor cores must be included in the project description. (118-11)

Response: Appropriate changes to Section 2.2.2.2 have been made to clarify anticipated reactor temperatures.

3.12 Comment: Include the number of engine systems to be tested. How many combinations of hardware will be tested, number of runs per year, run duration, thrust level? (2-25)

Response: Most of these data were included in Sections 2.2.2.2, 2.2.2.3 and 2.2.2.4; these sections have been revised to clarify this issue.

3.13 Comment: What happens to the hydrogen after the radioactive material is removed? (2-47)

Response: As discussed in Section 2.2.3.1, the contamination would be removed from the hydrogen in the ETS, then the hydrogen would flow to the flare stack, where the hydrogen would be burned.

4.0 LOCAL COMMUNITY

4.1 Comment: The study assumes that all employees would be in-migrants. Has consideration been given to the transfer of NTS workers who may lose their jobs due to the recently approved

Nuclear Test Moratorium? Will crossover training be considered, and if so, is it necessary? (109-6)

Response: The analysis assumes that all employees would be in-migrants so that analysis would maximize impacts to population growth, potential requirements for additional housing, public services, etc. that could create indirect environmental impacts. This approach is the most conservative method of identifying potential impacts. It is understood that some or all of the necessary jobs (both construction and operations) would be filled by local people; any environmental impacts would be reduced by using local population for these jobs. Some level of training may be required to accomplish the SNTP program; it is currently unknown if or how much training would be required.

4.2 Comment: The DEIS does not discuss the indirect employment effects of the SNTP program. (4-12)

Response: The EIS addresses only those socioeconomic issues with a reasonable causal relationship to an impact on the natural or physical environment, as provided by 40 CFR 1508.14. Population and direct employment effects from the SNTP program were analyzed to determine if the program would cause effects on housing, public services, etc. that might have an indirect environmental impact. Based on the slight population and employment changes identified from the SNTP program, no need for additional analysis was identified. Indirect employment effects (additional jobs in the region of influence not directly tied to the SNTP program, but occurring due to increased population and/or increased income in the area) would be slight and are not quantified.

4.3 Comment: The No-Action Alternative should be analyzed in terms of economic/community impact. What socioeconomic effects would be caused by the SNTP program not going to either site? Look at the proposed action in terms of whether not selecting INEL over NTS would negatively impact the eastern Idaho area. (200-1)

Response: In accordance with NEPA, the No-Action Alternative was analyzed for potential indirect environmental effects. Socioeconomic effects need only be reviewed in context of indirect environmental impacts caused from additional jobs, and population increases.

5.0 LAND USE

5.1 Comment: The EIS does not address the fact that NTS alternative land utilization will be evaluated during the present Environmental Restoration activities, and that (underground nuclear) testing

activities are anticipated to permanently cease in the very near future. Consideration of the alternative land usage at the conclusion of the project should be addressed. The DEIS does not adequately address potential land use conflicts with changing mission requirements at NTS from ceasing of underground nuclear tests, a DOE proposal to site low-level and mixed waste at NTS, etc. The land use patterns at NTS are changing. (106-5, 107-6, 170-6, 170-8)

Response: There are currently no known specific land proposals for changes to land use at NTS, aside from DOE (and other agency) nuclear test, storage, disposal, and related activities. As stated in Section 4.3.1, the use of the SMTS for SNTP is consistent with the NTS mission and land uses. Development of impact analysis based on a suite of possible future changes would be speculative at best. The radioactive release levels projected from the SNTP Program are acceptable by current standards, and therefore no known impacts to other potential future land uses can be identified.

5.2 Comment: The DEIS does not adequately address potential land use conflicts with the proposed Yucca Mountain waste repository site on NTS. Repository siting guidelines (10 CFR 960) stipulate that various military activities may not significantly affect repository siting activities. The guidelines further require that the quality of the environment be adequately protected during repository siting. Potential long-term institutional conflicts may occur. (107-5, 170-5)

Response: The Yucca Mountain Waste repository site is currently undergoing site characterization to determine if it is an acceptable site as a nuclear waste repository. 10 CFR 960 (e.g., 10 CFR 960. 5-2-4) states guidelines that must be used to identify and select a suitable site, rather than stating other programs must comply with repository site characterization. If the characterization process indicates that it would be a suitable site, then the Yucca Mountain program would be required to develop its own NEPA documentation. Based on program scheduling, the Yucca Mountain NEPA documentation would then include the SNTP program (if the SMTS is selected as the SNTP site location) as a potential cumulative impact for land use and other resources. Based on the analysis of the SNTP program, impact to the Waste Repository site characterization process are believed to be minimal or none.

6.0 HAZARDOUS MATERIALS AND HAZARDOUS WASTE MANAGEMENT

6.1 Comment: There is insufficient detail on the handling of nuclear waste. There is no discussion of high-level waste generation, the

destination of high level waste, transuranic (TRU) waste, or how the waste reactor cores will be handled. High-level waste disposal facilities are not available; by definition the reactor cores are high level waste. Note that storage of high-level waste is not allowed in Nevada. (1-14, 1-19, 1-21, 5-1, 106-2, 107-15, 107-19, 117-3 118-3, 118-58, 170-15, 170-21, 199-5)

<u>Response:</u> Description on how radioactive waste is categorized has been added into Section 3.5. Based on these descriptions, details on how the SNTP-generated wastes (including the cores) would be categorized and managed has been added in Sections 3.5 and 4.5. In summary, the SNTP program would not generate high-level waste or transuranic waste, and generation of mixed waste is not expected.

6.2 <u>Comment:</u> The FEIS needs more detail on the amounts and impacts of wastes generated from operations, effluent cleanup, and facility decommissioning and decontamination. Volumes of some wastes are not described in sufficient detail (4-1A, 54-1A).

<u>Response:</u> Additional clarification of waste volumes has been added to the text; see Section 4.5.1.3. Wastes generated from operations and effluent cleanup would be virtually synonymous. Approximately 95 percent of the waste would be generated from decontamination and decommissioning; the remainder would be from operations.

6.3 <u>Comment:</u> The FEIS should address waste management techniques (e.g., segregation, waste minimization and waste reduction, alternative facility uses following completion of the SNTP program) and other mitigation measures. (4-2, 4-18, 36-1, 54-2 103-1, 109-2, 171-17)

<u>Response:</u> The program has committed to the implementation of a waste minimization plan (Sections 4.5.1.2 and 4.5.2.2). Additional text on waste management techniques was added to the EIS. Both NTS and INEL have waste management/waste minimization plans which include installation-specific issues, goals, requirements, etc. The SNTP program would comply with the plans for the selected installation, including any appropriate waste minimization measures. Specific measures are discussed as potential mitigating measures.

6.4 <u>Comment:</u> The low-level waste (LLW) analysis at INEL is insufficient, because the Radioactive Waste Management Complex (RWMC) only accepts waste up to 10 nanocuries per gram, not 100

nanocuries per gram, as stated in the DEIS. SNTP wastes above 10 nanocuries per gram do not have an identified disposal facility. (4-3, 54-3)

Response: The text has been revised to address this issue (Section 4.5.2.3).

6.5 Comment: There are currently no disposal sites for mixed low-level wastes. Describe the interim management techniques at INEL. (54-4, 171-10)

Response: INEL currently is permitted under RCRA Part A for 225,000 cubic meters of storage for regulated waste. Currently, approximately 62,000 cubic meters of regulated waste is being stored, leaving sufficient capacity for additional waste.

6.6 Comment: The FEIS should not assume the Waste Isolation Pilot Plant (WIPP) site or some other facility will be available. Also, INEL can only send 20 percent of its TRU waste to WIPP (if it opens); SNTP waste may not be able to be sent to WIPP. DOE must provide for alternate disposal of SNTP waste should WIPP not open. (4-4, 118-43)

Response: TRU waste will not be generated by PBR validation testing. See Section 3.5.

6.7 Comment: Clarification was requested on the calculations used to identify storage capacity impacts from LLW. (38-1)

Response: Annual NTS disposal of LLW (without SNTP) is 880,000 cubic feet. After losing 8.8 million cubic feet of space from the current remaining space (10 years of non-SNTP disposal into current availability of 17.7 million cubic feet), the disposal area would have 8.9 million cubic feet available capacity. The 1.6 million cubic feet generated by SNTP would then be 18 percent of the available (i.e., 8.9 million cubic feet) capacity at NTS. The 1.6 million cubic feet is 9 percent of current capacity (17.7 million cubic feet). The same calculation process was used for INEL (3.5 million cubic feet remaining, 102,000 cubic feet per year for non-SNTP programs, and 1.6 million cubic feet for SNTP). Also, see response to comment 6.24.

6.8 Comment: The practice of dumping low-level waste in unlined trenches at the RWMC at INEL is an illegal practice; SNTP low level waste would exacerbate the situation. INEL's RWMC subsurface disposal area does not meet nor is it permitted by Resource

Conservation and Recovery Act (RCRA) Subtitle C or D. SNTP cannot use this site for waste disposal. (118-35, 118-45)

Response: The Subsurface Disposal Area at RWMC is operated legally through DOE's authority under the Atomic Energy Act and is in compliance with all applicable DOE Orders and requirements. There is no current Federal or State regulation for having lined trenches for LLW disposal activities. The bounding volume of LLW estimated to be generated from the SNTP program and annual LLW generation from other operations has been determined to fit within the existing disposal pit volumes.

The RWMC Subsurface Disposal Area does not receive solid waste or hazardous substances as defined by RCRA. Subtitle D requirements apply to municipal landfills. Subtitle C requirements apply to hazardous waste. Because the Subsurface Disposal Area does not receive either of these wastes, no conditions exist for considering a permit under RCRA.

6.9 Comment: The DEIS only gives a brief description of INEL waste management capabilities. Detailed assessment of new SNTP activities, and the facilities that would be used by SNTP must be considered. (118-41)

Response: As discussed under previous comments (e.g., 6.1, 6.3, 6.4, 6.5, 6.6), the hazardous waste considerations have been analyzed. Section 4.5.2.3 discusses INEL waste management practice, and additional detail has been added to the text.

6.10 Comment: No mention is made of the Superfund status of INEL (including RWMC and Contained Test Facility [CTF] as Waste Area Groups). (118-46)

Response: The status of INEL as being on the National Priorities List (Superfund), and summaries of sites near CTF with specific concerns, are provided in Section 3.5.2.4. Section 4.5.2.4 identifies that no impacts associated with these sites are expected; additional text has been provided to clarify the analysis.

6.11 Comment: Contamination of soil from accidents, and the subsequent decontamination or disposal must be analyzed. (118-48)

Response: There are no specific regulatory requirements defining measures taken to decontaminate or dispose of soil contaminated by an accident. Appropriate measures would be taken based on size and amount of contamination, location and other factors.

6.12 Comment: The anticipated amounts of chlorofluorocarbons (CFCs) and other RCRA-listed hazardous materials must be stated. (118-55)

Response: The program design is not sufficiently mature to allow preparation of a detailed list of hazardous materials that would be required to support the program. The SNTP program would comply with RCRA and other requirements for the use of hazardous materials and disposal of hazardous waste. The use of substantial amounts of CFCs is not likely, due to the implementation of production bans in 1995.

6.13 Comment: Shipment of waste from this program should not circumvent local government's authority to restrict shipments (e.g., time of day, routes, pre-notification) from NTS. Mechanisms should be established between Federal and local government agencies. (109-1)

Response: Comment noted. The transportation of materials to support the SNTP program would comply with all applicable regulations.

6.14 Comment: The document does not provide a description of how the hazardous materials would be transported to the site, the timing of the shipments, and a discussion on the risks involved with the volume increases. (109-4)

Response: Various aspects of hazardous materials/waste transportation is provided in Sections 4.5.1.1, 4.5.1.2, 4.5.2.1, 4.5.2.2, 4.12.2.2, 4.12.2.3, 4.12.3.2, 4.12.3.4, and Appendix E, Section 3.0. This level of detail is sufficient to identify the expected environmental impacts and risks.

6.15 Comment: The discussion of the shipment of fresh fuel to NTS lacks specificity, attention to emergency response issues, and fails to address the additive risks related to these shipments on Nevada's highways. The transportation of fuel (to either site) from Lynchburg, Virginia, as well as any on-site transportation, required analysis including RADTRAN analysis of risk and safety. (109-5, 171-6)

Response: As presented in Appendix E, Section 3.0, analysis of radiological impacts of the transportation of fresh fuel and other radioactive materials (primarily wastes and irradiated reactor cores) is provided, which accounts for the expected impact of the entire proposed test program. This is based upon available data concerning accident risk and consequences during transportation accidents. The impacts presented in Table E-22 through E-27 thus account for all impact due to proposed radiological transportation

operations, including transportation within Nevada and NTS borders. Factors considered in this analysis include the distances and road types across which transportation occurs, the quantities of fresh fuel or other radiological material contained in a shipment, the security of the shipping containers, and the expected probability of accident occurrence.

6.16 Comment: A statement on Page 3-15 states that the NTS currently has a permit for generation of polychlorinated biphenyl. This statement is incorrect. (106-6)

Response: The statement (Section 3.5.1.1) has been deleted.

6.17 Comment: The EIS does not discuss decontamination and decommissioning of the facility at the completion of the project. How much and what types of wastes would be generated? What disposal facilities would be required? (106-8, 118-47)

Response: The decontamination and decommissioning process is discussed in Section 2.2.2.5. Waste generation from this process is included in the waste analysis for LLW (Sections 4.5.1.3 and 4.5.2.3).

6.18 Comment: The DEIS calculates that the disposal of LLW at the NTS RWMS would be 18 percent of the annual amount disposed at the RWMS. The DEIS does not state the basis of this calculation. It is unclear whether the amount was based on existing generation and disposal, or future shipments from off-site DOE facilities. (107-11, 170-12)

Response: Comment 6.7 describes the calculation process in further detail. Assumptions used for baseline waste generation included existing levels of generation and disposal, and that these levels would be static over the SNTP program life. Considerations of future shipments from other DOE facilities is discussed in Sections 4.5.1.4 and 4.5.2.4 for NTS and INEL, respectively.

6.19 Comment: The Environmental Restoration and Waste Management (ER&WM) Implementation Plan states that the NTS will be considered as a regional disposal site for LLW. DOE/HQ has proposed NTS as a regional treatment, storage, and disposal site for TRU, low-level, and mixed waste. It is unclear if there is sufficient space for SNTP waste and from regional disposal. Cumulative forecasts should include scenarios for regional disposal. (107-12, 170-7, 170-13, 170-19)

Response: Forecasts of amounts of disposal from regional sources are unknown, and therefore, cannot be considered in detail. Additional text on the potential for cumulative effects from this program is provided in Sections 4.5.1.4 and 4.5.2.4. NEPA documentation to support the ER&WM program could include the SNTP program as a potential cumulative impact for additional analysis.

6.20 Comment: The DEIS fails to identify if the ETS would generate liquid waste. Because the RWMS cannot accept liquid waste, a means of treating such waste would be needed. (107-14, 170-14)

Response: No liquid (radioactive) wastes are projected from PBR validation testing. The text has been revised to discuss liquid wastes in Section 3.5.

6.21 Comment: During the scoping period, information provided to the public suggested that SNTP program would only generate a "few grams" of radioactive waste; now the DEIS states that there would be 1.6 million cubic feet of LLW as well as other types of waste. How did the numbers change so drastically? (5-3)

Response: The "few grams" stated earlier referred only to fission products generated in the reactor core during the testing process, rather than waste from the entire program.

6.22 Comment: The program would create an enormous amount of radioactive waste. Where will the waste be stored and for how long? (167-2)

Response: Section 4.5.1.3 discusses disposal and storage of radioactive waste if SMTS is selected; Section 4.5.2.3 discusses these factors if CTF is selected.

6.23 Comment: The 590 cubic feet annual amount of wastes (INEL) cannot be verified. The Hazardous Waste Storage Facility discusses cubic feet; DOE reports to Idaho in pounds. The DOE must ensure consistency. Existing capacity stated in the DEIS (6,500 cubic feet) exceeds design capability listed in RCRA Part B permit (3,200 cubic feet). (171-7)

Response: Section 3.5.2.2 has been revised. The Hazardous Waste Storage Facility at INEL is permitted to have a total storage capacity of 17,040 gallons (2,278 cubic feet). Its allowable maximum annual throughput is 127,000 gallons (16,980 cubic feet). The current average annual throughput for this facility is 24,310 gallons (3,250 cubic feet).

6.24 Comment: Conflicting amounts of annual LLW are shown for INEL. Eleven million cubic feet is listed in Chapter 3, 102,000 cubic feet is listed in Chapter 4. The DOE submitted an FY 1993 estimate of 80-100 cubic feet. Clarify. (171-8)

Response: The RWMC estimate of future annual disposal rate in the Subsurface Disposal Area is 80,000 to 100,000 cubic feet of LLW. The use of 102,000 cubic feet in the EIS analysis provides for conservative results. The 11 million cubic feet reference has been removed from the EIS. No value or estimate has been submitted to the State of Idaho.

6.25 Comment: Personnel resources and physical capacity would be affected by decommissioning efforts at other INEL facilities and ongoing environmental restoration. Have these issues been included in capacity analyses? (171-9)

Response: The physical capacity of the INEL Subsurface Disposal Area is presented in terms of remaining LLW capacity. SNTP requirements and identified requirements for other INEL activities are then projected against this capacity in Section 4.5.2 to determine if sufficient waste disposal capacity is available for these potential uses. Since decommissioning activities of other INEL facilities may involve unknown quantities of LLW, and be generated in an unspecified time frame, it is not possible to include such waste in this analysis. However, after accounting for SNTP and other known INEL needs, approximately 26 percent of the facility's current available capacity would still be available at the conclusion of SNTP activities.

6.26 Comment: The FEIS must identify the volume of land disposal restricted (LDR) wastes expected to be generated (mixed or hazardous), and the available treatment technologies. (171-11)

Response: The SNTP program has committed itself to minimizing the amount of waste materials produced during testing activities in accordance with DOE orders 5400.1, 5400.3 and 5820.2A. Section 4.5.1.2 presents the expected volumes of nonradioactive hazardous waste which would expected to be produced during testing. However, identification of specific waste types, and subsequent development of treatment/disposal procedures would be addressed during the final system design process. All procedures would comply with applicable treatment and disposal requirements, including LDR for specified waste types.

6.27 Comment: The amount of TRU waste must be specified. (118-42)

Response: TRU waste will not be generated by PBR validation testing. See Section 3.5.

6.28 Comment: The INEL TRU storage area is inadequate. The waste is stored in tents which have experienced failure from snow loads and RCRA violations. (118-44)

Response: TRU waste will not be generated by PBR validation testing. See Section 3.5.

6.29 Comment: The subsurface geology at INEL can readily transmit contaminants to the aquifer and offsite. INEL should be disqualified as a candidate site for SNTP and radioactive waste dumping. The DEIS does not address the environmental impact of spent fuel and waste storage and disposal. (108-2, 118-49)

Response: The storage and/or disposal of SNTP radioactive materials and waste would occur at the RWMC, which complies with all applicable laws, regulations, permits, and DOE orders for the storage/disposal area. Adequacy of the site as a disposal area is not within the scope of this analysis, because it is not permitted, regulated, or monitored by the SNTP program.

6.30 Comment: The contention that there is no TRU waste in excess of 100 nanocuries is unfounded. The assertion that the only high-level waste will be spent fuel is unfounded. (118-34)

Response: Initial calculations of fuel burn-up indicate that, due to the short times to which individual cores would be subjected, insufficient concentrations of transuranic material would be formed to classify the waste core materials as TRU waste. No waste from the program would be classified as TRU or as high level waste.

6.31 Comment: The DEIS does not address the question of long-term handling of the high-level radioactive fuels used in the reactors for the sub-scale and full-scale test facilities. This is a related effect; the FEIS should provide information on handling and disposal of this material after use at the facility. (201-3, 201-6)

Response: As is discussed in Section 3.5, the irradiated fuel elements from the reactor cores would be considered LLW and be disposed of in facilities at either NTS or INEL. Some of the used materials may be removed from the site for further testing/evaluation; ultimate disposal of these materials would be in

accordance with applicable regulations and DOE Orders. No high-level waste will be generated.

7.0 AIR QUALITY

7.1 Comment: What effect will the PBR validation tests have on heating the atmosphere around the site? Will the tests speed up greenhouse effects? (16-1)

Response: The tests would generate heat; the heat would be local and would not contribute measurably to global warming. The hydrogen flare itself would not generate typical "greenhouse gases" (e.g., carbon dioxide, sulphur dioxide, etc). Flaring operations would be intermittent (on the order of a few hours per test), rather than continuously. The primary combustion products from the flaring of hydrogen are nitrogen (N_2 from the atmosphere), water vapor (H_2O), oxygen (O_2 from the atmosphere), and unburned hydrogen (H).

Small quantities of carbon monoxide (CO), nitrogen dioxide (NO_2), and particulate matter (PM_{10}), which are regulated by the National Ambient Air Quality Standards, may be generated if a natural gas pilot system is used to ignite the hydrogen. Other ignition systems that generate little or none of these emissions (e.g., electric glow plugs) could be used in place of a natural gas pilot system to reduce these small quantity emissions.

7.2 Comment: The amount of radiation from an accidental release would not meet the annual EPA exposure standard set forth under the Clean Air Act, Title 40 CFR Part 61, Subpart H. The DEIS failed to clarify this issue. (170-22)

Response: The regulation listed in the comment is the National Emission Standards for Hazardous Air Pollutants (NESHAP) exposure standard used in the EIS analysis (Section 4.12). The NESHAP standard of not more than 10 mrem annual cumulative dose to any member of the public due to airborne emissions applies only to normal operations. Accident dose limits are based on ANSI/ANS Report 15.7.

8.0 BIOLOGICAL RESOURCES

8.1 Comment: The desert ecology at NTS is fragile, and disturbance to one hundred acres would be detrimental to the desert environment and such an impact would be difficult to mitigate. (3-8)

Response: As stated in the DEIS (Section 4.7.1), impacts to biological resources at NTS would include the loss of approximately

100 acres of Transitional Desert Association habitat if the SMTS were selected as the site for the SNTP program. In addition, up to 1,000 Joshua trees could be impacted. However, no impacts to threatened or endangered species or sensitive habitats have been identified at the SMTS; therefore, no mitigation measures are required. Mitigation measures for desert tortoise from road improvements, etc., are already in place, and would apply regardless of whether PBR testing was conducted at NTS.

9.0 CULTURAL RESOURCES

9.1 Comment: The DEIS does not discuss the treaty of Ruby Valley, the claims made by the Shoshone Nation to the Nevada Test Site lands, and the potential impacts to the Nation if the SNTP program proceeds at NTS. Identify social impact to the Shoshone Nation. (1-6, 1-15, 2-38, 3-4, 3-5, 3-21, 4-16, 20-3)

Response: The Western Shoshone claims to the NTS land cannot be supported because the Supreme Court, in a unanimous decision, ruled that the deposit of monies into a trust fund for the Western Shoshone in compensation for the United States "taking" of lands, including the current NTS, constituted payment under the Indian Claims Commission Act of 1946, 25 U.S.C. Section 70 et seq. (United States v. Dann, 470 U.S. 39, 105 S.Ct. 1058 84 L.Ed.2d 28 (1985)); such payment under the Act operates to bar any further claim. This case, along with a subsequent Ninth Circuit decision, United States v. Dann, 873 F.2d 1189 (1989), provides unequivocal authority for the conclusion that the aboriginal title of the Western Shoshone to lands encompassing NTS has been extinguished. Because of the court rulings, the Ruby Valley Treaty does not provide any further basis to sustain the Western Shoshone claim to NTS land.

The Shoshone Nation has not identified any specific social impacts. Because the SMTS is not a known sacred site, and because SNTP would not change existing land access restrictions, no social impacts from SNTP to the Shoshone Nation are known.

9.2 Comment: The EIS does not address the Indian Claims Commission findings that Saddle Mountain is a sacred place to the Shoshone Nation, and therefore this program at SMTS could have additional cultural impacts. (3-6)

Response: Saddle Mountain does not exist as a geographic/geologic feature. The actual site is located on a small ridge extending from the east side of Shoshone Mountain and was named "Saddle Mountain Test Station" in the early stages of this program. This

name was borne from the name of the road that runs through the center of Mid Valley (i.e., in the saddle between Shoshone Mountain, Mine Mountain, and Lookout Peak), which provides access to the site. In the development of the EIS, a good faith effort was made to solicit concerns from Native American groups through the scoping process, and the DEIS was mailed to 27 Native American organizations for review. To date, no Native American groups have indicated that the SMTS site is culturally sensitive.

9.3 Comment: Concern was raised that Native American interests were not addressed in the DEIS; that the Western Shoshone National Council was not consulted; a request was made by one Native American to meet with the program officials to discuss these issues. (3-7, 174-1)

Response: The commentor was contacted and potential methods to address Native American concerns (in general) were discussed. The Nevada Test Site American Indian Religious Freedom Act Compliance Program has identified 17 tribal groups with historic or cultural ties to the NTS. These tribal groups represent the Owens Valley Paiutes, the Western Shoshones, and the Southern Paiutes. One Native American monitor representing each group currently participates in archaeological excavations on the NTS, and their purpose is to ensure that traditional cultural properties, burials, and sacred sites and objects are identified during excavation and given proper treatment. Each monitor has been sanctioned by their respective groups. Similarly, although no sites of religious significance have been identified on INEL, the installation has a Memorandum of Agreement with the Shoshone-Bannock tribe which provides for the utilization of site monitors, should it be necessary. As a result, sections 4.8.1.5 and 4.8.2.5 have been modified to discuss potential mitigations.

9.4 Comment: A comment was made that, if the CTF is a historical site, then the SNTP program would only follow in its historic tradition, and there should be no concern of impacts to historical resources. (4-15, 4-17, 37-1)

Response: As discussed in the EIS, the CTF has been determined eligible to the National Register by the Idaho State Historic Preservation Officer. The potential for impacts arises from the structural modifications that would be required for use of the CTF for SNTP program activities; however, mitigation measures have been developed that will allow the SNTP program to modify and use the CTF.

9.5 Comment: Based on the potential for the CTF to be eligible for the National Register of Historic Places, the Idaho State Historical Society has been consulting with the DOE and EG&G Idaho on possible mitigation measures. The mitigation in this consultation process is consistent with the measures described in Section 4.8.2.2. (158-1)

Response: Comment noted. The text of these measures has been moved to Section 4.8.2.5.

10.0 GEOLOGY AND SOILS

10.1 Comment: A "pretty good quake" occurred in 1983 in the INEL area. Seismic activity at INEL is underestimated, and may cause accidents/releases. (18-2, 118-50, 118-51, 118-52, 171-13)

Response: As discussed in Section 3.9.2 of the EIS, the INEL can be subjected to large earthquakes from nearby areas; the largest recorded earthquake measured 7.3 on the Richter scale (1983), centered approximately 55 miles from the CTF. No structural damage at the INEL was experienced from this earthquake. The seismic risk of the INEL has been studied. Detailed design of the facilities would include consideration of seismic potential and incorporate applicable seismic code design requirements. Regardless of the actual seismicity, the primary concern from an earthquake would be strong ground motion during a test activity, causing an accident. Because of the infrequency and short duration of the tests, a concurrent strong earthquake is an unlikely event. Credible accident scenarios are analyzed in Section 4.12 and Appendix E; these bounding case accidents would also apply in the event of an earthquake causing an accident. Section 4.9.2.2 of the EIS has been modified to discuss this potential situation.

10.2 Comment: The potential for seismic activity at NTS in the Basin and Range Province is underestimated. Note the recent earthquake at Little Skull Mountain. The underground weapons testing at NTS provides additional ground shock to the geology above those caused by natural events. Nuclear facilities should not be built that close to these types of shocks. (3-11, 7-1, 19-2)

Response: Based on ground accelerations from the underground tests (Section 3.9.1), the facilities could be designed to withstand these types of shocks. Standard practice at NTS is to design facilities in the forward areas (which includes the SMTS site) to meet the criteria of seismic zone 4 of the Uniform Building Code (UBC). All facility designs would meet DOE design criteria. Reactor accidents from ground motion from underground tests would be

prevented by scheduling/coordinating events, so that both PBR validation tests and underground tests would not occur at the same time. In addition, Vulnerability Analyses are conducted prior to every underground weapons test to evaluate potential impacts on facilities and equipment from the test and to enable protective measures to be taken.

10.3 Comment: A comment provided additional information on geological/seismic conditions at INEL and requested consideration be given to recent studies indicating the seismic nature of the Eastern Snake River Plain. (184-1)

Response: As discussed under comment 10.1, recent studies indicate that the INEL area (i.e, the Eastern Snake River Plain) may have relatively low seismicity. This consideration has been added to the text in Sections 4.9.2.2 and 3.9.2.

10.4 Comment: Flooding of the CTF may be possible; therefore this site should be excluded from consideration. Also, the RWMC, which would be used as a disposal site by the SNTP program, is also subject to flooding. (118-40)

Response: Additional data on flooding potential of the CTF and immediate vicinity have been added to Sections 3.9.2.1 and 4.9.2.1. Analysis of flooding potential of the RWMC was not performed as part of this study because the SNTP program would be providing wastes to the RWMC for storage/disposal within existing allowable amounts; this issue is more relevant to any RWMC environmental documentation.

In addition, engineering controls (e.g., diversion dams) have been installed near the CTF and the RWMC to minimize the likelihood of flooding.

10.5 Comment: The potential for volcanic activity (and impacts to the SNTP program, with possible accidents/releases as a result) at INEL is not adequately addressed. (118-53)

Response: As evidenced at the Craters of the Moon National Monument, approximately 50 miles from the CTF, the youngest volcanic activity in the area is basaltic lava flows (approximately 2,000 years ago). These flows are slow enough that danger could be predicted, and the facility could be safeguarded (i.e., nuclear materials removed) prior to the onset of danger. If a more explosive event (e.g., an eruption comparable to Mount St. Helens or Mount Pinatubo in the Philippines) occurred, the facility could be damaged. Based on the known volcanic history of the area, this type of event

is much less likely than a basalt flow event. Damage from an explosive event could lead to an accidental release; as with seismic events, the results of such an accident are covered by the bounding case scenarios discussed in Section 4.12 and Appendix E.

10.6 Comment: DOE initiated probabilistic and deterministic seismic risk assessments for the INEL as part of New Production Reactor (NPR) site suitability review process. SNTP should complete these analyses. These assessments should be applied to the SNTP and completed with full disclosure of data, assumptions, and models used. (171-12, 171-18)

Response: Known geologic/seismic data of the INEL area, coupled with conservative bounding case accident scenarios analyzed in Section 4.12, are sufficient to analyze the potential environmental impact for this analysis. Seismic risk studies could provide additional information on the "realistic" levels of impact, but these impacts would be less than those included in this analysis.

11.0 WATER RESOURCES

11.1 Comment: Will the drought have any effect on the water use requirements of the SNTP program? (18-1)

Response: The water for SNTP would be a small increase over current use at NTS of 695 million gallons per year, or a moderate increase over the 37 million gallons per year used by INEL (but would be a very small portion of the 500 billion gallons used throughout the Snake River Plain). The impact of additional water use during drought years is greater than during non-drought years. There are more demands on water for agriculture, domestic lawn care, etc. during periods of low rain fall. However, drought conditions would not increase the water requirements of the SNTP program itself.

11.2 Comment: Chapter 3 of the DEIS suggests groundwater movement under the NTS is very slow, and therefore transportation of contaminants off-site need not be considered. However, the average rate of flow is estimated to within two orders of magnitude; this shows the uncertainty of the statement. Evidence that this lack of knowledge is recognized by the DOE is the recently initiated multimillion-dollar Groundwater Characterization Plan which has an ultimate goal of characterizing the flow regime beneath the NTS. Discuss this uncertainty. (106-7)

Response: The uncertainty in groundwater flow rates discussed in the comment are not important considerations for the SNTP

program. The SNTP program would not introduce anything into the soil or groundwater during any of its normal operations, aside from sanitary wastewater (a new septic tank leach field would be installed at SMTS). Spills would be prevented to the greatest extent possible, and the program would follow all requirements to ensure spills were cleaned immediately following the incident, thus preventing groundwater contamination. Wastes would be disposed in legally permitted facilities, environmental considerations of which were factored into their permitting processes.

11.3 Comment: In addition to the cited sources of recharge of the Snake River Aquifer, contributions from percolation ponds should be considered. Water quality discussions must include chemistry of wastewaters, management techniques, and all regulatory requirements. (171-14)

Response: Recharge to the Snake River Plain aquifer from percolation ponds is very important and considerable effort has been made to utilize this recharge to minimize the overall effects of pumping from the aquifer at INEL. Water that is discharged to the percolation ponds is actually derived from pumping water from the aquifer nearby. The INEL has made efforts in the past to reduce the quantity of water pumped from the Snake River Plain aquifer. The only potential input from SNTP in terms of percolation ponds and wastewater would be from the use of existing evaporation ponds for sanitary wastewater near the CTF. These ponds are permitted, and are not expected to affect water quality, because the use would be limited to sanitary wastewater.

11.4 Comment: The DEIS states that groundwater quality meets drinking water standards and ignores individual areas above regulatory standards (INEL). (171-15)

Response: The plumes of water above regulatory standards in the Snake River Plain aquifer are generally decreasing and most waste concentrations have been decreasing in the past 20 to 30 years. This is a result of decreased quantities of waste being discharged, improved disposal methods, increased removal of waste products from waste streams, recycling of some waste streams, and other factors. The areas where water quality exceeds the regulatory standards are also becoming smaller. Predictive models and other data analysis indicate that no drinking water wells on the INEL will be above the regulatory standards in the future.

11.5 Comment: Potential effects of SNTP groundwater withdrawal on Test Area North (TAN) groundwater remediation must be considered and disclosed in the FEIS. (17[illegible]

Response: The SNTP program is expected to use about 3 million gallons of water per year. The water would be pumped from wells located about 1,500 feet east of the CTF. Three million gallons per year is a rate of 5.7 gpm, or about 1/3 of the discharge of a garden hose. The two CTF wells were used to pump 111 million gallons of water in the first 6 months of 1991 or an average rate of 222 million gallons per year. This pumping rate had no influence on the waste plume at TAN.

The influence of pumping 5.7 gpm from the CTF wells for one year would have a drawdown of only 0.05 feet in the pumped well and only 0.01 feet at a distance of 5,000 feet. The CTF production wells are located about 3,800 feet northwest of the westernmost edge of the TAN waste plume. Therefore pumping at the rate of 5.7 gpm would not have any appreciable effect on the groundwater systems at the TAN area, nor would it cause any change in the waste plume direction or velocity. Because there was no effect on the plume from pumping 111 million gallons in 6 months, pumping at higher rates (over shorter time periods) for SNTP should not affect the plume.

11.6 Comment: The Snake River Aquifer does not meet 1976 Environmental Protection Agency (EPA) Drinking Water Standards for gross alpha and beta concentrations. New standards (scheduled for prorogation in 1993) are substantially higher than 1976 limits. (113-28)

Response: Comment noted. The data provided by the commentor appear to be from a percolation pond containing process water (i.e., wastewater). This water would not be used as drinking water, and, therefore, drinking water standards do not apply. Measures of radioactive constituents from several INEL wells indicate that the levels of contaminants in the drinking water are below established EPA limits.

12.0 HEALTH AND SAFETY

12.1 Comment: The program has been described as being as safe as reasonably achievable. Why is this used rather than the minimal allowable standard? Which method provides more safety? What happened to a minimal allowable standard for safety that is no go? (1-1)

Response: *Minimal allowable standards for safety will be met.* "As low as reasonably achievable" (ALARA) is a self-imposed restraint that is more stringent than regulatory requirements. ALARA requires that levels of human exposure to radioactivity not just comply with

the applicable regulatory standards, but that exposure be reduced as far below those standards as reasonably possible.

12.2 Comment: Are there any safety implications due to the heat generated during reactor operations? (1-5)

Response: There are worker-safety concerns; the safety hazards associated with high-temperature reactor operations have been identified in the preliminary design phase of the PBR test program. Test and maintenance procedures would be tailored to reduce or eliminate identified hazards.

12.3 Comment: The safety analysis is insufficient. The possibility of an accident is such that an out-of-control accident would occur over a greater time than indicated in the DEIS; and therefore, release more radiation. The DEIS calculates the worst case exposure on the basis of 1,000 seconds of reaction time, with maximum exposure of 200 mrem. The DEIS does not explain why an out-of-control reaction that leads to meltdown or explosion would stop at 1,000 seconds. The resulting estimates of radionuclides present and the dose delivered are thus inaccurate. (1-12, 107-16, 118-6)

Response: Physical limitations on the reactor system design would make it physically impossible for the reactor to operate at its expected power level for periods significantly longer than the planned run time (1,000 seconds), even if there is a complete loss of control functions. Unless the coolant is available at the rate needed to cool the reactor, the reactor would very quickly overheat, the fuel elements would either melt or vaporize, and fuel would be expelled from the core, rendering the core subcritical and incapable of supporting further reactions. Thus, the potential for generating radioactive fission products during the operation of the reactor would be inherently (i.e., regardless of the availability of control systems) limited to the quantities considered in the DEIS. The consequences of such an event are considered as the Consequence II-late scenario analyzed as the maximum credible event.

12.4 Comment: There is insufficient detail in the DEIS on containment and control of the nuclear reactor. Include specific design systems for control, including the ability to SCRAM (automatic shutdown of reactor). (1-13, 6-1, 108-4, 116-1, 118-26)

Response: The EIS is intended to provide sufficient information to enable an evaluation and comparison of the potential environmental consequences of the proposed action and alternatives. The level of information presented in this analysis is sufficient to fulfill this purpose with regard to performance of PBR containment and control

systems. Additional details developed during design and SAR process would conform to issues and impacts included in this EIS.

12.5 Comment: The EIS does not state that the design and construction of the ETS must, as a minimum, meet the standards set forth in 10 CFR 50. (1-22, 5-4)

Response: ETS design and construction would meet the intent of all appropriate requirements specified in 10 CFR 50. The text has been revised to clarify this point.

12.6 Comment: Question the accuracy of comparing the radiation dosage of chest X-rays to the SNTP program. Question equating internal deposition of particles (from ingestion) and their health effects with the external dose of X-rays. (114-1)

Response: The inclusion of a comparison between ionizing radiation dose which could be received during the SNTP ground testing and that received during a medical diagnostic test such as a chest X-ray was provided as an illustration of the relative magnitude of the SNTP potential exposure, to allow the lay person a reference from which comparison can be made. The comparison is not intended to provide a definitive comparison of potential effects, which are more specifically analyzed and presented for identified SNTP release scenarios. The analyses reported in the EIS include the health effects of both external and internal exposures.

12.7 Comment: Concern was raised on the effects of fallout on native plants, animals, and humans from past programs at NTS, and the additional accumulation of radioactive material from numerous programs with small releases (such as SNTP). (2-1, 2-20, 168-1)

Response: Consideration of radiation effects in this EIS includes analysis of accumulation of radioactive materials within the biosphere. Background levels used as a baseline in the EIS for additive effects includes a value for radiation caused by previous nuclear programs at each of the alternative sites. However, due to the conservative nature of the analysis and the small increases identified above existing radiation levels at either NTS or INEL, consideration of effects on specific plant and animal species was not considered to be necessary.

12.8 Comment: Question the total PIPET failure as the bounding case accident scenario. The complete failure of the two gigawatt engine (GTA) should be analyzed. What would happen if the turbopump disintegrates and damages the control system? (2-16, 17-2, 17-6, 118-13)

Response: The potential for an accident involving a GTA core which exceeded the impact of a Consequence II "Late" PIPET accident was investigated and is discussed in Section 4.12.2.3 and Appendix E, Section 2.4. Accidents such as the turbopump scenarios are included within the bounding conditions of the analysis.

12.9 Comment: What would prevent the critical mass detonation and how will techniques be validated? (2-17, 17-3)

Response: A critical mass detonation would be physically impossible for a PBR core; there would be no means for the stability of the core to be maintained while an uncontrolled chain reaction became highly supercritical. Physical integrity of the core would be lost and it would cease to sustain a chain reaction even under the most drastic of conceivable situations.

12.10 Comment: A suggested accident scenario is the explosion of the hydrogen gas, destroying the reactor and creating contaminated dust and an airborne radioactive cloud. (19-1, 106-1)

Response: Implications of hydrogen accidents to reactor operations are presented in Section 4.12.2.1 and in greater detail in Appendix E.

12.11 Comment: Questions were raised on whether the use of uranium particles, their coatings, high temperatures, and the introduction of liquid hydrogen have been tested, and whether this testing would be safe. Would high temperatures, high pressures, high vibration and high noise levels affect the fuel particles? (2-18, 2-31, 2-45, 3-9, 17-10, 21-1, 30-1, 118-9)

Response: The fuel particles, including the coatings, would be subjected to extensive testing to ensure that they are able to survive the stresses posed by the expected applications. Many of these tests, involving high temperatures, hydrogen, high radiation fields, etc., would be performed in existing test facilities before the tests described in this EIS are initiated. This EIS describes the testing in which all the operational environments occur simultaneously. One purpose of these tests is to demonstrate that a reactor based on PBR technology could be designed with an adequate margin of safety between the operational requirements and the fuel capabilities.

12.12 Comment: What is the likelihood of explosion in which the particles would become airborne and carried down wind? (2-45)

Response: There is no credible means for fuel particles to become airborne for any appreciable length of time. As indicated in Section 4.12.2.1, the potential for explosive release of the core contents is not considered to be feasible, hence there can be no direct release and lofting of fuel particles due to hydrogen explosion. Individual fuel particles which may be carried from the PBR core in the hydrogen stream would be captured in the ETS and would be unable to be released to the environment.

Failure of fuel particles during operations may allow the release of some uranium fuel from the core; however, the ETS design efficiency of 99.9 percent for particulate materials would prevent release of almost all fuel materials. The analysis of the PIPET Normal III operation includes consideration of the release of a small fraction of available material by escaping both the core and ETS, and being released to the environment as part of the operation's source term.

12.13 Comment: A comparison of the calculated SNTP radiation releases to the amount of exposure that has been measured at various stations in southern Utah stations was requested. (2-26)

Response: It is not practical to provide a direct comparison of the monitoring information currently obtainable from sites located around NTS (including southern Utah), and the results provided in this EIS from MACCS analysis. The bulk of the data available from monitoring sites surrounding NTS are presented in units of microcurie of a given type of radiological material (plutonium, tritium, beta-emitting nuclides, etc.) per milliliter of air (i.e. airborne concentrations); the averaging period for these samples is generally 1 day. Such results are not compatible with the 50-year committed doses calculated for the proposed test program. Where measured dose results are available (for personal and area gamma exposure monitoring using dosimeters and Pressurized Ion Chambers), the results, given in milliroentgen or mrem on an annual basis, are all within the expected range for natural background radiation, hence contributions due to NTS operations are indistinguishable within these ambient levels. By contrast, the MACCS-calculated values for the 50-year committed doses represents discrete exposures above any background levels (in practice, the low values calculated would be indistinguishable from the ambient levels).

The overall conclusion based upon the monitoring activities conducted around the NTS during 1991 is that while small releases of radioactive material were known to have occurred, none was detected by the offsite monitoring networks. This represents a similar situation to what is known about proposed SNTP operation.

Calculations have shown that some release of radioactive materials may occur, the effects of which can be postulated using sophisticated computer modeling techniques. However, even using very conservative assumptions concerning potential releases, the calculated effects have been shown to be quite small, and would likely be undetectable by the monitoring networks.

12.14 Comment: The EIS should include a discussion of the techniques used to make calculations of radioactive concentrations to which the public might be exposed. Also, additional discussion on the techniques used for establishing and analyzing the bounding case conditions should be included. (2-33, 118-32)

Response: The MELCOR Accident Assessment Code System (MACCS) was used to provide analysis of the potential reactor operations' consequences. Appendix E, Section 1.0 provides a thorough discussion of the methodology and assumptions used in the analysis of the normal and accident case consequence analyses for PBR reactor test operations.

12.15 Comment: Questions were raised on the safety of the liquid hydrogen storage tanks, and what could happen during an explosion or during accidental non-explosive release (venting). (2-46)

Response: A complete analysis of consequences of an accident associated with liquid hydrogen transportation, storage, and handling is presented in Section 4.12.3.4 and Appendix E, Section 5.0.

12.16 Comment: The ETS discussion states "...design to accomplish... radioactive materials remain in subcritical geometry." How is this accomplished? How can the ETS be designed to control emissions, when there is uncertainty in the composition of the effluent? How would the contamination goals be reached? Is attainment of these goals possible? (17-11, 118-18, 118-19, 118-20)

Response: The EIS presents the SNTP program's stated design constraints concerning ETS performance. Specific design details have not yet been finalized. Numerous designs (e.g., physical separation or dilution) are being considered for ETS components; they would be selected and designed to perform to standards listed in the EIS. As stated in the EIS, these goals are within the envelope of the current state-of-the-art for filter and adsorption media. While more specific details would be incorporated into the SAR, this EIS contains sufficient information to enable an effective evaluation of the potential environmental consequences of the Proposed Action.

12.17 Comment: Tables E-3 and E-4 need to be translated into what they mean to a downwinder assuming 99.5% ETS efficiency and full ETS failure. (17-15)

Response: Tables E-3 and E-4, respectively, present the inventories of radioactive fission products present in a PIPET and a GTA core following a test operation at evaluated conditions (see Section 4.12.2.1). This information serves at the starting point for development of the MACCS analyses presented in this EIS, shown in Tables 4.12-4 through 4.12-9, and Tables E-7 through E-14, E-17 and E-18, which present the impacts to the exposed populations.

12.18 Comment: Ensure that the effluent stream is monitored for isotope releases, with feedback to shut down the reactor if releases are detected above criterion level. Also monitor air quality at the perimeter of the site. (3-10, 3-12, 30-2)

Response: Such monitoring and reactor control features would be considered during the detailed design and Safety Analysis Review processes.

12.19 Comment: Inadequate data are presented to conduct a complete technical review of the radiological analyses. Data such as chi/Q at the receptor locations, descriptions of radionuclide transfer through exposure pathways, inhalation rates, etc. are not provided. Revise Appendix E to include enough data so that an independent reviewer can duplicate the calculations. (40-1)

Response: Appendix E provides a level of technical detail which is sufficient to allow a conservative evaluation of upper bound potential impacts due to proposed SNTP activities. This includes presentation of the assumptions and inputs into MACCS, detailed information concerning core inventories, release fractions and ETS capture efficiencies, and impacts determinations as obtained from MACCS.

12.20 Comment: Information on the quality assurance status of MACCS is not included in the DEIS. Describe configuration management, verification, and validation of the MACCS model. (40-2, 118-33)

Response: The MACCS computer code is currently undergoing two rigorous quality assurance and verificiation processes: a line-by-line review of the computer code by the Idaho National Engineering Laboratory to check internal consistency, and a detailed chronic exposure pathway comparison to other recent consequence models by the Institute of Energy Technology (Kjeller, Norway). In addition, preliminary assessment of normal GTA operations by Sandia National

Laboratory (Hipp, 1992) using AIRDOS-PC (an EPA-approved model) indicated the extremely conservative nature of the MACCS modeling used for this EIS.

12.21 Comment: The EIS should discuss, at least on a qualitative basis, the potential impacts to critical populations around the INEL such as children. (40-3)

Response: The analysis was based upon general population averages, and does not discriminate between certain sectors of the population. Because the analysis used averages, it qualitatively considered both portions of the population more sensitive and less sensitive than the average, which allows for a determination of the overall program impacts as presented.

12.22 Comment: In Appendix H and Section 4.12.2, the EIS uses a value of 7.9×10^{-7} latent cancer fatalities/person-mrem to convert effective dose equivalent to cancer fatalities. For the doses cited in the EIS, a dose rate factor between 2 and 10 (see BEIR V) should be incorporated into the cancer rate estimator. A rate factor of two would be consistent with ICRP-60 and other environmental analyses at INEL. (40-4)

Response: ICRP-60 presents a latent cancer fatality rate for exposure to ionizing radiation of 5.0×10^{-7}. BEIR V presents several values for this risk, which are based upon observation of the effects incurred during acute exposure to various doses of radiation, ranging from 2 rem to 10 rem (referred to as dose rate factors), with a value of 7.9×10^{-7}. During development of this EIS, it was decided to utilize this BEIR V value for cancer risk, because it offers the most conservative estimate of the potential impacts associated with the proposed action. The use of this conservative value thus accounts for uncertainty in the low dose-rate assessment, and envelops the variances in risk estimate caused by various differences in age, sex and lifestyle within the exposed population.

12.23 Comment: The EIS includes 92.5 mrem/year medical radiation in the dose from environmental radiation. Medical radiation should not be included in this number; suggest changing the title or omit. NCRP-93 indicates that 53 mrem/year is more correct than 92.5 mrem/year. The value of 441 mrem for natural background radiation at INEL should be 400 mrem/year, including medical doses. (40-5)

Response: Comment noted. The contribution of medical X-rays to the annual environmental dose received at NTS and INEL has been replaced with a more recent estimate of 53 mrem. The resulting

values for annual environmental exposure at NTS is 383 mrem and at INEL it is 402 mrem. See response to Comment 12.46.

The term "natural environmental radiation" has been changed in the EIS to "environmental radiation."

12.24 Comment: The INEL has site-specific curves for atmospheric diffusion parameters. These curves should be used for plume meander to more realistically assess radiological doses. The selection of model weather conditions favors Nevada, but they are too restrictive and could lead to identifying increased exposures in Idaho. The plume from burning hydrogen can penetrate into the inversion layer, providing larger radioactive dispersion and decay, thus reducing off-site exposures. (4-9, 40-6)

Response: Based on the conservative assumptions used in the analysis, plume meander was not considered in the analysis. Because increasing plume averaging times to account for plume meander would reduce the dose at long distance, this analysis would not be conservative or bounding. Also, use of such site-specific data is more applicable to long-term analysis of continuous releases than to the analyses performed here.

It is understood that the plume could penetrate the inversion layers; a basic assumption that the plume would not penetrate the layer provides a conservative, bounding condition as used in this analysis. Consideration of plume penetration may reduce the impacts; this situation would be covered by the bounds of the current conservative analysis.

12.25 Comment: The EIS used 1.0 m/s wind speed; a correct value for INEL is 2.0 m/s (95 percent meteorological conditions). (40-7)

Response: Wind speeds of 1.0 m/s resulted in a somewhat higher consequence than the 2.0 m/s for distance out to approximately 60 kilometers (37.5 miles). The 1.0 m/s wind speed was not selected as representative, but was the speed that resulted in a conservative estimate of consequences. Analysis using this wind speed gives essentially the same total population dose, but may yield a higher maximally exposed individual (MEI) dose.

12.26 Comment: The EIS states that the dose to MEI excludes ingestion. NESHAP includes ingestion. Suggest revising the dose assessment to include the ingestion pathway so that a valid comparison to the NESHAP standard can be performed. (40-8)

Response: The explanation of the MEI dose found in Section 4.12.2.1 of the DEIS has been corrected to discuss ingestion. In determining the highest dose to any individual, MACCS does include an ingestion contribution by assigning a dose which reflects the average ingestion exposure received by members of the exposed population. While such a value does not represent the highest potential ingestion dose which an individual could receive, when combined with the conservative determinations of maximum potential dose to an individual due to other exposure paths it yields a very conservative estimate of the overall dose received by the maximally exposed individual, which can then be compared with the NESHAP standard. The description of the MEI determination found in Section 4.12.2.2 has been corrected to reflect this ingestion methodology assessment.

12.27 Comment: Test start acceptance criteria need to be described in the EIS, including an evaluation of the number of hours that NTS and INEL meet these criteria. (40-9)

Response: This EIS presents the dose-impact criteria which will be used to determine the acceptability of test start conditions (see Section 4.12.2.1). Under no circumstances will a test be permitted which has the potential to exceed the normal-case operating exposures presented in the EIS.

12.28 Comment: Suggest using stability class B or C, rather than D; these classes would give a higher dose nearer the site boundary. Suggest doing a complete meteorological evaluation of both sites and incorporating into the dose assessments to provide a more credible analysis. (40-10)

Response: The selection of stability class D was made in order to maximize the projected potential impact to the exposed populations presented in this EIS. Fumigation conditions, which may result in cases where stability classes B or C are present, has the potential to produce somewhat higher doses at the site boundaries; however, the impacts to the total exposed population dose would be reduced, which would be contrary to the goal of demonstrating maximum credible impacts in this EIS. The SNTP program is committed to ensuring that neither the MEI or the total population dose impacts will exceed those presented in this analysis.

12.29 Comment: An inconsistency was identified, where 2.6×10^{-7} genetic defects/person mrem is used, citing BEIR V. BEIR V uses 2.1×10^{-7}, not 2.6×10^{-7}. ICRP-60 uses a value of 1.3×10^{-7}. Because ICRP-60 is based on low doses and low dose rates, recommend using this value for calculations. (40-11)

Response: The document has been revised to reflect the value of 2.1 x 10^{-7} genetic defects/person-mrem (BEIR V). This higher value was used because it is in keeping with the more conservative approach used in impact analysis.

12.30 Comment: Which dose was multiplied by the genetic risk estimator to arrive at genetic risk? (40-12)

Response: The total population doses were used to estimate genetic risks. This provides a more conservative estimate of genetic risk than is the case with using gonadal dose only, which is in keeping with the conservative philosophy used in assumption development. The use of this value results in conservative estimate of genetic effects by a factor in the approximate range of 2 to 5.

12.31 Comment: Suggest that the FEIS include a comparison of test methods employed and potential radiation releases from the SNTP program compared to those of production reactors, nuclear submarine and aircraft carrier reactors, medical equipment, and releases from other tests at the two alternative sites. (22-2, 173-1)

Response: The radioactive releases associated with other types of reactors (such as naval nuclear systems or commercial power reactors) are not readily comparable to the releases to be associated with the PBR system. Most nuclear power systems operate with a closed-loop coolant system, in which materials which enter the reactor core are not permitted to be released to the environment during system operation. Exposures associated with such a system occur through releases due to escaping liquids, periodic release of some radioactive gases, and handling/transport of considerable quantities of waste materials generated during the operating cycle. By contrast, the PBR systems utilizes an open-loop coolant system, in which the primary exposures are due to the small releases associated with air release of the coolant plume. The types of radioactive materials released, principal exposure pathways and exposure timeframes which are associated with such different systems are widely contrasting, and do not allow for a meaningful comparison between the two systems.

12.32 Comment: Suggest comparison of pollutants emitted from conventional liquid or solid rocket propellants to the SNTP emissions. (173-2)

Response: Consideration of PBR as an alternative rocket motor to conventional solid propellants is outside the scope of this EIS, which is limited to the demonstration of PBR technology only.

12.33 Comment: A comment was provided that consideration should be given to "how reports can give the false sense of public health safety." (179-1)

Response: Whether a report gives a false sense of security depends on the accuracy and candor of the report. The proponent believes that this report is accurate and candid.

12.34 Comment: It is not clear from the DEIS if more than one reactor core would be on site at a given time. If this is the case, incident scenarios should include the consequences of the fission products of multiple reactor cores being scattered by a major accident event. (117-1)

Response: There could be multiple reactor cores at the selected site, based on status of the test program, at any given time. For example, the site could have a reactor core being prepared for testing, a core actually being tested, and a core that has already been tested. At either site, conditions exist (or would be incorporated into the detailed site design) so that they would be stored in a manner that precludes involvement of stored cores in any on-site accidents (including explosion of a hydrogen storage vessel).

12.35 Comment: Since the operational scenarios include experiments which test the limits of the core, and may include partial or full fuel element failure, some calculation of the probability of unintentional releases should be presented. These estimates should include the probability of, and health consequences due to, multiple unintended releases during the test period. (117-2)

Response: The consequences of multiple, unintended releases during the test period are reported in the health and safety analysis (Section 4.12). Normal III PIPETs, which are the operations most likely to result in potentially significant fuel failure/core release events, are analyzed assuming 100% of the core is released to the ETS. The release to the environment in that event would be the maximum credible unintended release and would be within the self-imposed limit of 20% of the allowable annual dose consequence. The program is committed to ensuring that the actual dose impacts will not exceed the maximum each year and program total impacts as presented in the EIS. That commitment will be implemented, in part, by not initiating any test if the maximum credible release from that event would cause an exceedance of the program's maximum year annual release impact as described in the EIS.

12.36 Comment: Will SNTP have a milk monitoring program (for radiation content), and how soon after each test would the monitoring be done? (2-5)

Response: Monitoring of milk, water, agricultural and animal products and other environmental monitoring programs by the Environmental Protection Agency is an on-going effort, and is not conducted in response to specific test events, or tied to specific programs. Such environmental monitoring provides information concerning long-term exposure trends in areas affected by the test sites due to the infiltration of radioactive materials into the food web. Where such programs are conducted (as at both NTS and INEL), the objective is to identify trends in the concentrations of radioactive materials due to facility operations, and cannot be used to evaluate the effects of individual non-accident test operations. A discussion of the existing monitoring programs is presented in Section 3.12.1 for both NTS and INEL.

12.37 Comment: When you say low level radiation is minimal or you don't have concern for low level radiation - it's the one that's most deadly. It's the one that's going to creep up 10, 15, 20, or 25 years later in our children and our grandchildren and the generations to come. (2-36)

Response: The radioactive materials that would be released under normal operations and those that could be released in the event of an accident would almost all be relatively short-lived isotopes. Only small amounts would be released under any scenario and very little of that would remain after the first year following a release. In contrast, the environmental background radiation across the United States is relatively constant. A discussion of ionizing radiation and its health effects is presented in Appendix H, Section 3.0.

12.38 Comment: No discussion of the change in fission products (as a result of multiple GTA tests with the same core) is provided as is discussed in the declassified EIS, the potential for greater amounts of fission product inventory, nor the potential implications to normal and accidental releases. The bounding accident scenario does not consider the inability to SCRAM (shut down) the reactor due to physical changes in the fuel arrangement resulting from cores that have been run in multiple tests. (118-7, 171-4)

Response: The increases in fission product inventory as a result of multiple tests with a single GTA core are considered in the analysis for this EIS. This is discussed briefly in the description of the Consequence II accident in Section 4.12.2.3 and in greater detail in Appendix E, Sections 1.3 and 2.4. The reactor control systems will

be designed such that multiple tests with a single core will not affect the ability to control or shut down reactor operations. (See the response to 12.3)

The additional operations discussed in the declassified EIS are not part of the scope of this document.

12.39 Comment: Hydrogen embrittlement of materials needs to be considered. (118-14)

Response: Consideration of hydrogen embrittlement is standard engineering practice in the design of all systems involving hydrogen. In this analysis, the specific effects of hydrogen embrittlement are not addressed. However, the potential consequences of embrittlement effects are included within the selection and analysis of bounding-case accident assessments which were performed.

12.40 Comment: A full assessment of transportation of fully assembled reactors with fuel needs to be included. (118-15)

Response: The SNTP program is not considering the transportation of fully assembled reactors, and therefore it is not analyzed in the EIS. Fully assembled cores (i.e., without the reflectors and control systems required to enable criticality) may be transported; analysis of this activity is included in Appendix E, Section 3.0. In accordance with Department of Transportation regulations, all cores would be transported in configurations which absolutely prevent criticality, and thus would be incapable of sustaining a chain reaction.

12.41 Comment: The exact number of tests run to failure must be identified. The source terms for dose to the public must reflect those tests. (108-5, 118-16)

Response: Anticipated operations in which fuel failure has the potential to occur have been classified as Normal III operations, and would be limited to PIPET cores only. As discussed in Section 4.12.2.2, there would be a total of 4 PIPET Normal III operations during the proposed action, which have been included in the evaluation of the total SNTP program dose consequences (Tables 4.12-6 and 4.12-7).

12.42 Comment: How long would test personnel have to remain in the control bunker after an accident? How much of INEL would be evacuated for each test? What evacuation plans have been made and tested for the surrounding area? (118-17)

Response: Development of specific plans for worker protection and revisions to existing emergency response procedures (including evacuations in the event of an accident) would be part of the Safety Analysis Report (SAR) process. The discussion in the EIS (in Section 4.12.2.4) shows that worker exposures can be kept well below regulatory limits; public exposures have been reported conservatively, without consideration of shielding and evacuation that would reduce those impacts.

12.43 Comment: Transportation of the reactor from the test cell to another location to allow for decay of fission products is hazardous and needs to be analyzed. (118-22)

Response: Transportation of radioactive test articles at both NTS and INEL will be accomplished in accordance with established procedures which have been used for past operations. In all cases, the risks inherent in the movement operations are well known, and specific procedures have been developed to minimize the potential for accident. Potential hazards will be limited to external radiation exposure in the areas where the movement occurs, due to potential gamma radiation exposure. During movements of unshielded cores, all personnel will be evacuated from the work area unless appropriate protection (shielded enclosures) are in use.

The consequences of any potential accidents occurring during movement activities at either site would be bounded by the analyses discussed in Sections 4.12 and Appendix E.

12.44 Comment: Questions on hydrogen safety, facility design issues associated with storage and use of hydrogen, the size of a potential explosion, and the effects of an inversion layer at INEL. Specifically, concern was raised that the analysis assumed an inversion layer at INEL that would restrict timing of tests, or that the plume from hydrogen burning/explosion would penetrate the inversion layer, thus changing the analysis results. (118-24)

Response: Section 4.12.3, and Appendix E, Section 5.0 provide a thorough analysis of hydrogen storage, potential hazards, and credible consequences. Potential accidents (e.g., hydrogen fires and explosions), and the resulting consequences, are included in these sections.

A basic assumption of the impact analysis at INEL was that the plume would not penetrate the inversion layer; this assumption was made to provide conservative results. Preliminary modeling for the SNTP program indicates that plume rise would penetrate the inversion layer before reaching plume stabilization height. This

condition would not restrict test scheduling; in fact, penetration of the inversion layer would reduce the levels of impacts below those presented in this EIS, by allowing additional dispersion of the plume constituents. An analysis of plume rise is provided in Section 4.12.3.2).

12.45 Comment: The beryllium release analysis needs to consider the presence of inversion layers at INEL. (118-31)

Response: An inversion layer was considered in the analysis to ensure a conservative result.

12.46 Comment: The natural dose used in the DEIS is too high. Background radiation at INEL is 144 mrem, not 441 mrem. Suggest remainder of existing dose is from previous activities at INEL. (118-37)

Response: In the INEL area, natural background radiation accounts for an exposure of 144 mrem/year for a typical person. However, this 144 mrem/year figure represents only part of an INEL-area resident's total exposure. As defined in Section 3.12.2, environmental radiation includes not only background radiation (exposure contributions from cosmic rays, naturally-occurring terrestrial radioactive materials, and naturally-occurring internal radiation), but also the U.S. average individual radon exposure (200 mrem/year) and various man-induced exposures to which the typical INEL-area resident is currently subjected (medical X-rays, consumer/industrial products, airline flights, etc.), totaling 58 mrem/year. The contribution of INEL site activities to this total is much less than 1 mrem/year. Together, these components of the radiation environment produce an annual exposure of 402 mrem for the typical person in the vicinity of INEL.

The 58 mrem/year represents a revised figure from that presented in the DEIS due to the incorporation of the updated value for average annual medical x-ray exposure from 92.5 mrem to 53 mrem (Comment 12.23). This revision is reflected in the FEIS for the annual environmental radiation exposures presented for both INEL and NTS). The term "Natural Environmental Radiation" has been revised to "Environmental Radiation."

12.47 Comment: Why is the Consequences I accident using a GTA core yield with a dose of "MEI of 560 mrem at a distance of 120 kilometers" not shown? These doses are considered understated. (118-38)

Response: As discussed in Appendix E, Section 2.4.2, the potential for catastrophic failure of the reactor core, accompanied by complete failure of the reactor containment system, was identified as a Consequence I accident. However, analysis of the proposed PBR systems has demonstrated that there is no credible means by which such an accident could reasonably occur. Instead, the Consequence II accident was found to be the maximum-release event which could be considered realistically capable of occurring, and was chosen for use in bounding-case accident assessments.

12.48 Comment: The fission inventory product (Appendix E, Table E-4) should be totaled. This practice has precedence in DOE's INEL Historical Dose Evaluation. Without the totals, clear or candid presentation cannot be claimed. (118-39)

Response: The analyses utilize the quantities of individual nuclides in determining the biological consequences of the potential exposures. The total of the inventory expressed in curies would be a substantially inferior description of the radiological hazard, because meaningful hazard evaluations are based upon summation of the effects attributable to each individual radionuclide (determined by the activity of that radionuclide which is released), not to the gross total activity.

12.49 Comment: The study does not compare the use of hydrogen and other non-radiological chemicals for the SNTP program with current NTS operations for transportation, emergency management, and toxic waste management. The study does not adequately discuss mitigation measures for new uses of hydrogen and other non-radiological chemicals. For example, the report states that rail car transport is a safer transportation alternative, yet it does not state that there is no rail route to NTS. (109-3)

Response: The transportation analysis for hydrogen and other non-radiological materials is extensive and sufficient to identify potential environmental impacts. Both NTS and INEL have emergency management plans; these would be updated as appropriate to reflect plans required for use of liquid hydrogen, etc. Non-radioactive hazardous waste, including mitigation measures, is discussed in section 4.5.

12.50 Comment: A request was made to share information with the public following the tests; requested information includes safety reports, levels of radioactivity in the effluent, and if there is damage to the reactors during individual tests. (3-14)

Response: Comment noted. As required by law, levels of radioactivity in the effluent would be provided to the state (either Nevada or Idaho, as applicable).

12.51 Comment: The consensus of the scientific community is that there is no threshold level of radiation exposure below which is safe. Therefore, comparisons of SNTP exposures should note that even natural exposure has some health hazard; SNTP would add to that hazard. Discuss in terms of added risk. (3-16)

Response: The scientific community has not reached a consensus relative to the quantified risk estimate associated with exposure to environmental levels of radiation. The normally expected rates of latent-cancer fatalities and genetic disorders presented in Section 4.12.2.1 represent average incidence rates in the U.S. for populations not subject to increased environmental risks such as above-background level radiation exposure (non-burdened populations). These rates include any contributions which may be due to existing environmental radiation exposure, as well as other environmental causes and non-exposure (random) disorder development. A discussion of the increased risk (i.e. increased incidence of latent cancer fatalities and genetic disorders) in the maximum exposed population due to SNTP-related radiation exposure is presented for the maximum-case year, total proposed test program, and the bounding-case accident in Tables 4.12-5, 4.12-7 and 4.12-9, respectively. These are based upon the application of a "no-threshold linear dose response" model of radiation effects, which is a conservative means of assessing dose consequences.

12.52 Comment: In the EIS, percentage values of expected average dose are given. The Idaho site seems to present a higher credible accident dose; however, the small doses at the two locations have a slight difference, which is insignificant. Include this statement in the EIS in comparing the two sites. (4-5)

Response: The text (Section 4.12) has been modified to relatively compare the doses from the two site alternatives.

12.53 Comment: The risks from the program need to be compared (quantitatively) to the benefits realized from the program. (4-6)

Response: Sufficient analysis has been performed to understand the environmental impacts from the proposed action; additional analyses of this nature are not required to evaluate these impacts.

12.54 Comment: The benefits of using a containment facility (i.e., at the CTF) have not been included in the analysis of impacts. (4-11, 4-13, 4-14)

Response: Comment noted. However, the bounding case events analyzed in this EIS would not be affected by the existence of a secondary containment facility because the primary reactor containment would be sufficient to withstand any credible accident (e.g., hydrogen explosion), so all analyses are based upon expected ETS function and/or failure in determination of the source term. It has not been determined whether the ETS would be located within the containment vessels. The conservative approach used in this analysis assumes that the ETS would not be located in the CTF vessel.

12.55 Comment: Section 2.2.3.1, under the ETS discussion, is not clear if the affected public was limited to persons off site or if appropriate consideration was given to NTS workers on site whose activities have no relationship to the proposed project. Such individuals should be classified as the public for the assessment of impacts. (106-3)

Response: Sections 4.12.2.2 and 4.12.2.3 present the impacts to the public; Section 4.12.2.4 presents the impacts to workers at NTS and INEL, both those involved with PBR activities and those assigned to other projects.

12.56 Comment: The DEIS mentions a new power line and associated step-down transformer for SMTS. No analysis of the negative effects on human health from high voltage power lines and transformers (i.e., electromagnetic fields) is presented. (106-4)

Response: The health effects of high voltage electric power lines and transformers on human health is the subject of much debate within the scientific community. There are studies that indicate that prolonged exposure to electromagnetic fields (EMF) may have negative effects on human health. However, these studies have linked these negative effects to field strength and prolonged exposure. To our knowledge, all of the studies have focused on the negative effects of transmission lines in the voltage range above 230 kV. The field strength generated by a 34.5 kV line has not been linked with these negative effects.

12.57 Comment: The DEIS does not consider past nuclear research and testing at NTS in the use of background radiation. (107-8, 170-10)

Response: The overall annual dose to a typical member of the public due to the NTS is included in the total environmental radiation exposure as presented for NTS in Section 3.12.2. This exposure is much less than 1 mrem.

12.58 Comment: The DEIS fails to consider other available data from ongoing radiation monitoring programs at NTS. (107-9, 170-11)

Response: The value presented for NTS-attributable radiation exposure (much less than 1 mrem) in Section 3.12.2 is based upon historical monitoring data gathered at NTS.

12.59 Comment: The possibility of SNTP activities causing resuspension of radioactive uranium and plutonium particles from areas on known on-site contamination should be considered in determining background radiation and program impacts. (107-7, 107-10, 170-9, 170-20)

Response: While several areas at NTS are known to contain surface contamination (plutonium and uranium), no SNTP activities would take place in these areas, thus construction activities would not result in any resuspension of contamination. During normal operations, SNTP activities would not involve disturbance which could result in significant resuspension of particulate materials anywhere on NTS. In the event of an accident, effects would be limited to the PBR test facility, and would not affect contaminated areas elsewhere on-site.

12.60 Comment: The approach of using the DOE SAR proce unacceptable. The analysis must be included in the DEIS. (107-17)

Response: The potential environmental impacts, including health and safety risk analysis, are reported in the EIS. The description of the SAR is included to provide information on the process that will be used to ensure that the impacts would be at or below those reported.

12.61 Comment: What are the long-term effects (10 to 30 years) of the SNTP program? (2-10, 2-23, 2-42)

Response: No additional SNTP operations would occur after the 10-year program lifetime, hence no additional radiological releases would occur. The exposed population may continue to receive some small additional exposure due to released radioactive materials which have been retained in the environment, however the contribution in this time-frame to the total 50-year doses presented in this EIS would be slight because most of the total dose attributable to SNTP

activities will be received in the first year following a release. The effects presented to the exposed population by the SNTP Program are based upon the cumulative dose received during the 50-year period following each individual release.

12.62 Comment: The SNTP ceiling of 20 percent of the NESHAP standard for radionuclides, even though it would not exceed the 10 mrem standard, would represent a significant increase in the amount of release from the site. (171-20)

Response: The value of 2 mrem per year to the highest exposed individual (20 percent of the NESHAP allowable standard) has been adopted by the SNTP program as an upper bound on this radiological impact as an initial planning limit which the Program considers to be acceptable, in accordance with the precepts of ALARA (see Comment 12.1). However, the results of the radiological impact analysis in this EIS, although quite conservative, show that maximum dose to any individual in the maximum case year would not exceed 1.35 mrem at INEL or 0.6 mrem at NTS, and in reality would likely be well below these values (due to the conservativeness of the upper-bounds EIS analysis). The SNTP program is committing itself to operate within the limits of these upper bounds established in this EIS, and would not operate in such a manner as to exceed these limits during PBR test activities.

12.63 Comment: The GTA Consequence I analysis numbers are not included in any tables explaining dose calculations nor is Consequence I distinguished by type of accident or exposed individuals. (171-21)

Response: As indicated in Section 4.12.2.3 and Appendix E, Section 2.4, the Consequence I accident is not considered to be possible because no credible means can be identified by which such an accident could occur. The impacts which would be produced by such an accident are provided in Appendix E, Section 2.4.3 as a baseline against which the magnitude of other accident scenarios can be compared, however, the Consequence II "Late" accident involving a PIPET core has been determined to be the bounding-case credible accident scenario based upon consideration of the actions/failures necessary for each accident type to be realized.

12.64 Comment: The DEIS states that dose decreases with distance; this statement is not supported. Time and distance data are necessary and should be included in the EIS. Reinstate and expand the graphs from the declassified version of the EIS. (171-22)

Response: The EIS presents upper-bound impact data as necessary for the evaluation of the environmental impacts associated with the proposed action based upon consideration of human health and regulatory limit criteria, and is performed using very conservative assumptions concerning source terms, meteorological conditions and dispersion patterns, population distribution, and existing evacuation/control measures. Such an analysis would be of limited usefulness in providing relevant time and distance data concerning dispersion of radiological contaminants. The SAR process would consider the information necessary for a more useful evaluation of such information in consideration of necessary emergency response procedures based upon system design information rather than more conservative upper-bound considerations used in this EIS, and would be completed prior to the start of any test activities.

12.65 Comment: The DEIS establishes a 170 mrem go/no go decision point in uncontrolled areas. Define uncontrolled areas, and explain the rationale for 170 mrem. (171-23)

Response: 500 mrem is the total whole-body emergency public exposure guideline (established in ANSI/ANS Report 15.7); 170 mrem was developed by DOE as a conservative estimate based on being (approximately) one-third of the 500 mrem accidental dose. The DOE and EPA have defined "controllable area" as "those areas where trained rad-safe monitors are available, where communications are effective (where the exposure of each individual can be documented), where people can be expected to comply with recommended remedial action, and where remedial actions against uptake of radionuclides in the food chain are practicable." Uncontrolled areas are any areas outside these controllable areas.

12.66 Comment: The DEIS selects low ceilings for accident scenarios, which represents a conservative estimate for determining potential impacts. However, a hydrogen explosion is treated as an individual phenomenon in later sections. Instead of remaining within the bounding areas, a hydrogen scenario would produce a fuel product at 3.2 kilometers high. This scenario should be considered in the radiation impacts for dispersion. (171-24)

Response: The analysis of the area which would be contaminated in the event of a hydrogen explosion is analyzed in the most conservative manner possible in Appendix E, Section 4.1. Unlike the analysis of direct radiological exposure, which is maximized by considering the existing inversion layer to completely restrict plume rise, the extent of an area contaminated by large particulate emissions is maximized by ignoring any inversion ceiling. This is due to the greater area over which particulates would settle as total rise

height is increased. Imposition of an inversion ceiling would only serve to reduce the amount of area which could potentially be contaminated as presented in this analysis, and would not be in accordance with the goal of providing conservative, bounding-case analyses in this EIS.

12.67 Comment: The DEIS presents radiological releases from operations based upon 5 test operations. In fact, a correct estimate is 120 operations over the project's lifetime. Present the complete picture for assessment. (171-25)

Response: The total number of full-power-equivalent operations evaluated in consideration of the PBR test program lifetime impact is presented in 4.12.2.2, and would consist of 46 PIPET Normal II operations, 10 GTA Normal II operations and 4 PIPET Normal III operations, for a total of 60 PBR test operations in a ten-year period. Up to 15 EITs, which do not involve nuclear materials, would also be performed.

Section 4.12 has been revised to improve readability.

12.68 Comment: Table E-5 contains selected radionuclides with short half-lives. No explanation is given for excluding a majority of the inventory of Tables E-3 and E-4. This exclusion causes an incorrect evaluation of dose models in the DEIS. (171-26)

Response: Table E-5 presents specific core escape fractions for 55 isotopes which have been determined to be responsible for approximately 75 percent of the total committed dose due to test releases. However, as presented in Section 4.12.2.1 and Appendix E, Section 1.3, release of the remaining core inventories of radioisotopes presented in Tables E-3 and E-4 has also been considered in the development of the source term releases and resulting impacts. However, because computer evaluation of specific release fractions for these isotopes was not available, estimation of releases was performed using the methodology outlined in Table E-6, and the resulting information included in the MACCS impact assessment.

12.69 Comment: The MACCS polar grid does not represent population patterns; site specific data should be used. 1990 Census data are now available; the 1980 data should be updated; these changes would change the person-rem dose calculations. Figure E-1 includes shaded areas not defined and is not explained. (171-27)

Response: The analysis of radiological impacts at INEL has been revised in the FEIS to incorporated complete 1990 Census data,

which has become available since the DEIS. Also, Figure E-1 has been revised to clarify the MACCS analysis methodology.

12.70 Comment: Data in Table E-13 should be compared to MESODIF to assure that underlying assumptions are accurate. (171-28)

Response: MACCS was determined to be an adequate model for the bounding weather conditions, the plume altitudes, and dispersion distances of concern in the EIS. Other models (including MESODIF) would be considered for use in the SAR process.

12.71 Comment: A previous program resulted in uncontrolled releases of radioactivity into the environment. What safeguards do the public have to ensure that the multiple uncontrolled releases of radioactivity into the environment will not happen again. (167-3)

Response: There were accidental and intentional uncontrolled releases in the past that would not be permitted and could be avoided now. Regulatory limits on releases to the environment and required preventative measures developed and instituted through the SAR process effectively preclude the possibility of multiple, uncontrolled releases. Potential accidental releases were analyzed for the EIS and the maximum credible releases of radioactivity were found to be well within regulatory limits.

12.72 Comment: The design for radiation exposure is no more than 20 percent of the EPA standard (10 mrem per year to an individual). Consequence II would expose the population of southern Nevada to 23.5 mrem, or twice the EPA standard. Is this consistent? (170-16)

Response: The NESHAP standard of not more than 10 mrem annual cumulative dose to any member of the public due to airborne emissions of radionuclides is intended to apply to normal operational releases only. This limit does not apply to releases such as Consequence II scenarios, which can only occur in the event of an accident. Under such circumstances the limit of 500 mrem total whole-body dose based on ANSI/ANS Report 15.7 is appropriate.

12.73 Comment: A worst-case accident scenario would subject workers at Yucca Mountain (Area 25) and at Mercury (Area 23) to an estimated peak dose of up to 200 mrem. Is this consistent with EPA standards? (170-17)

Response: As discussed in the responses to Comments 12.55 and 12.82, prior to test operations, determinations will be made concerning areas at the highest risk in the event of an accident. Personnel in these identified areas, which could include Area 25

and/or Area 23, can be evacuated prior to testing as a precautionary measure. Throughout the rest of the NTS, access will be limited to authorized personnel in order to allow rapid evacuation of other areas should an unforeseen event occur.

12.74 Comment: The DEIS does not address the need for a public review and state oversight programs as part of DOE's SAR process. (170-23)

Response: NEPA procedures are intended to ensure only that the decision-makers are fully informed of the environmental consequences of Proposed Actions and reasonable alternatives before they decide to proceed. Whether the public should be afforded an opportunity to participate in the SAR process presents no such impacts and is therefore beyond the scope of the EIS.

12.75 Comment: The DEIS does not identify how radioactive gases would be retained in the ETS. No specific design exists in the document. (118-21)

Response: As discussed in Section 2.2.3.1, the gases would be removed from effluent cryogenic charcoal absorbers and/or cold traps, retained for several days to allow for decay of short half-life constituents, and released to the atmosphere. Design options are discussed in Comment/Response 12.16.

12.76 Comment: Hazards associated with hydrogen explosion inside the CTF are not discussed. (118-23)

Response: Potential impacts of hydrogen buildup within the CTF, and measures to prevent these impacts, are discussed in Section 4.12.3.3.

12.77 Comment: Comments on the amount of plume power and plume rise from hydrogen flaring were provided. Based on data in the EIS, a very large amount of power would be produced in burning the large quantities of hydrogen, and the heat plume would rise to very high altitudes. The burning hydrogen would penetrate the inversion layer. (4-10, 118-25)

Response: Analysis of the hydrogen plume has been provided in Section 4.12.3.2. Additional text has been provided to discuss plume size and potential impacts from flaring.

12.78 Comment: The declassified EIS of the earlier PBR program (1991) indicates low inversion layers at INEL, and that, because of these layers, PBR tests would be in violation of NESHAP except in the

afternoon on summer months. Is there a commitment to restrict tests to summer afternoons? (118-27)

Response: The modeling in the SNTP EIS assumed no penetration of the inversion layer as a conservative assumption. Even in this case, NESHAP standards would not be exceeded during normal operations. Penetration of the inversion layer, which could occur, would further reduce potential exposures. Therefore, there is no need to restrict these activities solely on inversion characteristics. The program would consider various meteorological factors, and would schedule tests accordingly.

12.79 Comment: The total maximum committed effective dose equivalent (CEDE) and collective CEDE must be recalculated to reflect real site characteristics, and without a one-day holdup, because the ETS design cannot guarantee holdup. There is no guarantee that the wind will be blowing in the right direction, the wind will not shift, or that tests will run on summer afternoons. (118-36)

Response: The meteorological conditions used in this analysis represent conservative bounds on anticipated facility conditions which will be encountered at NTS and INEL. It is anticipated that actual test conditions would be much less conservative than conditions assumed in this EIS, resulting in less significant impact than projected in the EIS. The program is committed to ensuring that test impacts would not exceed the impacts shown here. The ability to hold up release of volatile radiological components to allow for decay of short-lived isotopes is considered a dose-limiting operational parameter of the ETS, a capability which would be incorporated into the system design. The inability to contain volatile isotopes would be considered a system malfunction or accident, and would be bounded by the maximum-case accident presented in Section 4.12.2.3.

12.80 Comment: "The operational doses are based on percent understanding of release fractions that will be further defined by the [blank] test program and are likely to be modified." [FEIS 4.8-2] This statement suggests that considerable increases in doses could be anticipated as the project progresses, and public reliance on the stated doses being conservative is not warranted. (118-54)

Response: The quoted sentence is from the formerly classified FEIS and refers to a different propulsion program. It is not applicable to the proposed action in this EIS. The comment also implies an incorrect interpretation of the statement as it appeared in the FEIS. It says only that the release fractions were not well known and the estimates would be refined as empirical evidence became available.

Even substantial changes to the release fractions of given isotopes would not necessarily increase the resulting MEI or population doses. In that document and this, doses are estimated conservatively. If it were discovered later that the estimates were inaccurate to a significant degree, supplementary analyses would be performed.

12.81 Comment: There appears to be a potential conflict between the security intensive activities for the SNTP and the public, civilian activities performed by the DOE Office of Civilian Radioactive Waste Management at Yucca Mountain. It is likely, given the number of public and special tours being conducted around Yucca Mountain, that tour buses might well wind up sharing either Jackass Flat Road or Lathrop Wells Road with shipments of "irradiated specimens" or engine components. This potential safety issue should be addressed in the DEIS. (199-4)

Response: There should be no particular site-specific safety issue associated with sharing of NTS roadways by tour buses and other "civilian" traffic, and SNTP-dedicated radiological shipments. Such road- sharing presents similar hazards to the road-sharing which occurs during radiological shipping operations using public roads and highways. Thus, any road-sharing hazards associated with the NTS roadways are more globally addressed in the transportation hazard analysis provided in Appendix E, Section 3.0.

12.82 Comment: The division of populations at risk during severe accidents (Appendix E, Section 2.4) needs to be reviewed. The assumption that the at-risk public exposure area begins at the NTS fence cannot be made. An additional analysis should be done for each scenario using wind direction to the southwest, assuming the public is either at the Yucca Mountain field office, or on top of Yucca Mountain, whichever is more conservative. (199-6)

Response: Prior to every test, a plan would be developed to ensure all actions are identified to provide for health and safety of personnel, both on and off-site. The Yucca Mountain Project would have to be involved in this pre-test planning, which would include provisions concerning personnel remaining on station during test operations, and control of personnel authorized site entry. At that time, decisions could be made concerning the potential test impacts to the Yucca Mountain Project and the potential concerns regarding test effects would be used to determine the need to minimize staff and halt public access to the Yucca Mountain field office during the test activity.

12.83 Comment: The SNTP facility must comply with NESHAP standards; a permit to construct must be obtained from the EPA unless forecast

emission levels fall below the permit threshold. Compliance will require more detailed technical design information and emissions evaluation as part of the Application to Construct (40 CFR Part 61, Subpart H). At a meeting with the EPA in September, 1991, the DOE indicated that it intends to apply for a permit even if emission levels are not anticipated to exceed this threshold; the EPA supports this position. (201-2, 201-8)

Response: As detailed in Section 1.1 of Appendix E, modeling and other requirements of 40 CFR Part 61, Subpart H would be followed in determination of regulatory compliance. The comment on EPA support for NESHAP permit application is noted.

12.84 Comment: Modeling of safety issues (radioactive releases) were performed for reactor operations and transportation of radioactive materials; however, it is not clear that the DEIS takes into account potential effects of failures in the effluent treatment system and emergency venting. For example, what is the potential for, and the risks of, a hydrogen explosion which could damage the ETS? The FEIS should provide an analysis of risks associated with failure of components of the ETS and should discuss appropriate mitigation. (201-7)

Response: There are two reasons failure of the ETS was not analyzed. First, no credible means for complete rupture, including hydrogen explosion, has been identified for the ETS. As a result, a complete release of the ETS radiological inventory is not considered to be credible. Second, even if the scenario was credible, it would have less effects than the bounding case scenario (Consequence II "Late") that is analyzed in the EIS. These reduced effects are caused by the relatively smaller inventory of radioactive material which would be in the ETS (and therefore, available for accidental release) during a normal operation. Section 4.12.3.2 has been edited to enhance readability.

12.85 Comment: Impacts to Nevada State Highways from the two items of contention (additional traffic volumes and risk potential from accidents) were found to be nominal. (202-1)

Response: Comment noted.

13.0 General

13.1 Comment: I favor the SNTP program and would like it to be tested at INEL. (3-B, 3-E, 3-F, 3-H, 4-A, 4-B, 4-C, 4-D, 4-E, 4-F, 4-H, 4-I, 4-J, 4-K, 4-L, 4-M, 4-N, 4-O, 4-P, 4-Q, 4-S, 4-T, 4-U, 4-V, 4-W, 32-A, 35-A, 41-A, 42-A, 43-A, 44-A, 45-A, 46-A, 47-A 50-A, 51-A,

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Response: Comment noted and will be provided to the decision-maker for consideration.

13.2 Comment: I favor the SNTP program and would like it to be tested at NTS. (1-A, 1-B, 1-D, 1-E, 1-F, 1-G, 1-H, 1-I, 1-L, 1-M, 1-O, 1-Q, 1-U, 9-A, 13-A, 115-A, 132-A, 141-A, 147-A, 148-A, 149-A, 150-A, 154-A)

Response: Comment noted and will be provided to the decision-maker for consideration.

13.3 Comment: I am in favor of the SNTP program. (1-K, 4-G, 4-R, 10-A, 14-A, 80-A, 92-A, 95-A, 137-A, 138-A, 172-A)

Response: Comment noted and will be provided to the decision-maker for consideration.

13.4 Comment: I am opposed to the SNTP program. Choose the No-Action Alternative. (1-C, 1-J, 1-N, 1-P, 1-S, 1-T, 2-A, 2-D, 2-F, 2-G, 2-I, 2-J, 2-N, 3-A, 3-C, 3-D, 3-G, 5-A, 12-A, 19-A, 20-A, 23-A, 24-A, 25-A, 27-A, 29-A, 107-A, 119-A, 144-A, 155-A, 157-A, 167-A, 168-A, 175-A, 176-A, 177-A, 178-A)

Response: Comment noted and will be provided to the decision-maker for consideration.

13.5 Comment: Risk perception should be distinguished from risk and considered in context. (1-R)

Response: Comment noted and will be provided to the decision-maker for consideration.

13.6 Comment: The money could be better used elsewhere. (2-B, 2-H, 2-K, 2-L, 33-A, 34-A, 110-A, 111-A, 180-A)

Response: Comment noted and will be provided to the decision-maker for consideration.

13.7 Comment: Any risk is unacceptable. (2-C)

Response: Comment noted and will be provided to the decision-maker for consideration.

13.8 Comment: What is the program cost? (2-E)

Response: The estimated costs for the Proposed Action are $800 million. Costs estimates for follow-on activities, if any, cannot be made until plans for such activities are formulated.

13.9 Comment: Are the proceedings (i.e., the public hearings) going to be taken into account by the decision makers? (2-M)

Response: Yes.

13.10 Comment: SNTP should consider including future DOE and NASA space propulsion programs as well as future international cooperation to avoid unnecessary duplication of facilities. (4-X)

Response: Comment noted.

13.11 Comment: Finish the test program in less than the planned 10 years. (30-A, 32-B)

Response: Comment noted. The schedule will be affected by funding and technical considerations.

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	4	Michael D. Weeks	
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	4	Cliff Brady	
	4	Bruce Jenson	
	4	Rick Trembley	
	4	Stephen Watts	
	4	Arnold Ayers	
	4	Ira Koplow	
	4	Philip McDonald	
	4	Rocky Deschamps	
	4	C.E. White, Jr.	
	4	Darrol Gardner	
	4	John Kester	
	4	Jim Okeson	
	4	John Tanner	
	5	Boris Bernstein	
	6	Gary Scruton	
	7	Elizabeth G. Anness and others	Citizens Alert
	8	Louis Loupias	
	9	William Templeton	
	10	David Thomson	
	11	Daryll Geerts	
	12	Scott Galindez	
	13	Daryl Schwichtenberg	
	14	James Bilau	
	15	Roy Clark	
	16	Rocky Schmatz	
	17	Colin Harrison	
	18	Connie Cripps	
	19	Daniel Clark	
	20	Sara Penny	
	21	Karen Mort	
	22	Kenneth Sizemore	Community and Economic Development, Five County Association of Governments
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	24	Sherry Schmalz	

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	30	Walter Wagner	
	31	Rosemary Holt	Women Concerned about Nuclear War
	32	Bryce Jones	
	33	Corinne Schneider	
	34	Scott Fife	
	35	Philip Rice	
	36	Unknown	Idaho Section of the American Nuclear Society
	37	Brent Dixon	
	38	Chris Ischay	
	39	Anthony Zuppero	
	40	Dr. Steve Maheras	
	41	Steve Symms	U.S. Senator
	42	R. Scott Hartley	
	43	Jeff Schrade	Bonneville County Republican Party
	44	James McClure	Former U.S. Senator
	45	Abderrafi Ougouag	
	46	Elwood Stroupe	
	47	Patricia Stroupe	
	48	Hans Chi	
	49	Stephen Watts	
	50	Kenneth D. Bulmahn	
	51	J.D. Williams	State Auditor
	52	Richard H. Stallings	House of Representatives
	53	Linda Milam	
	54	David Humphrey	Idaho Dept. of Health and Welfare
	55	Clyde A. Burtenshaw	Board of Commissioners, District #3
	56	Beulah Kenney	
	57	Margaret Rice	
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	59	Upendra Sinha	
	60	Brian Minner	
	61	David Hobson	
	62	Ira Koplow	Greater Idaho Falls Chamber of Commerce
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	64	Arnold Ayers, Jr.	

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	85	Marilyn Brower	
	86	Jeffrey Brower	
	87	Lucy Bean	
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	93	James Adams	
	94	H.M. Jones	
	95	Lyle Dolven	
	96	Kris Stanger	
	97	Dick Kenney	
	98	Ann Rydalch	
	99	Larry Craig	U.S. Senator
	100	Grace Guemple	Eastern Idaho Technical College
	101	C.E. White Jr.	
	102	Dick Kenney	
	103	Dr. J. Stephen Herring	American Nuclear Society
	104	Paul L. Weeks	DOE Services, Idaho

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	106	Paul J. Liebendorfer	Department of Conservation and Natural Resources, Nevada
	107	Chris Brown	Citizen Alert, Southern Nevada Director
	108	Beatrice Brailsford	Snake River Alliance
	109	Dennis A. Bechtel	Clark County, Department of Comprehensive Planning
	110	Alice H. Welker	
	111	Garr W. Welker	
	112	Mr & Mrs. Lyn E. Harwood	
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	114	Thomas P. O'Farrell	
	115	T.E. Davis	
	116	David Buden	
	117	Kenneth W. Holt	National Center for Environmental Health
	118	Chuck Broscious	Environmental Defense Institute
	119	Sandy Ferrell	
	120	Jeff Schrade	Assistant to Senator Larry E. Craig
	121	Mike Hodge	
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	124	June Hoffman	
	125	Jack B. Ellsworth Sr.	
	126	Peggy Jo Cook	
	127	Ron Clawson	
	128	Concerned Citizens	Greater Idaho Falls Chamber, Employees Louie's Pizza (17 names)
	129	R. Scott Hadanid	
	130	Stephen L. Walston	E. ID Regional Medical Center
	131	Jeffrey E. Jones	
	132	Janed V. Taranik	Desert Research Institute
	133	David M. Smith	
	134	Merrell C. Smith	
	135	Brenda Shaw	
	136	Harold W. Davis	
	137	Jerry Foisel	Lockheed
	138	Danny C. Demings	
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	145	Nile L. Boyle	Mayor, City of Rexburg
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	148	Bob W. Barker	Local Union 357, IBEW
	149	Robert B. Steenbergen	
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	156	Kamercer	
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	170	Robert Loux	State of Nevada Agency for Nuclear Projects Nuclear Waste Project Office
	171	Steve R. Hill	State of Idaho Department of Health and Welfare
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	173	Kenneth L. Sizemore	Five County Association of Governments
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	176	Mrs. Ken Whitwood	
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	181	James V. Hawkins	Department of Commerce
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	197	Connie and Tom Waliath	
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	199	Roger Dehart	Inyo County Planning Director
	200	James Tortorelli	
	201	Deanna M. Wieman	Environmental Protection Agency Region IX
	202	Ron Sparks II	Nevada State Clearinghouse Coordinator

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COPY

UNITED STATES AIR FORCE
PUBLIC HEARING

on the

DRAFT ENVIRONMENTAL IMPACT STATEMENT

for the

SPACE NUCLEAR THERMAL PROPULSION PROGRAM

at the

DESERT INN HOTEL & COUNTRY CLUB
3145 South Las Vegas Boulevard
Las Vegas, Nevada

Tuesday, September 8, 1992
7:00 o'clock p.m.

Hearing Officer	COL. JAMES HUEPEL USAF Judiciary
Proponent	LT. COL. GARY BLEEKER Phillips Lab
Environmental Program Manger	LT. COL. GARY BAUMGARTEL AFCEE-ESE
Cooperating Agency	MR. JOHN LEPPERT DOE/NV

A G E N D A

Introduction	Col. James Huepel
Environmental Process	Lt. Col. Gary Baumgartel
Proposed Action	Lt. Col. Gary Bleeker
Environmental Impacts	Lt. Col. Gary Baumgartel
Comment Period	OPEN

Reported by: Harold St. Thomas, CSR No. 130

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COL. HUEPEL: We might as well go ahead and get started. I welcome you to the public hearing on the Draft Environmental Impact Statement for the Space Nuclear Thermal Propulsion Program. We want to thank you for coming tonight. I solicit your involvement, your comments during tonight's hearing, during the public input portion of the hearing.

I'm Col. Jim Huepel. I'll serve as the presiding officer for the public hearing tonight. I am the Chief Trial Judge for the Air Force and I am assigned to Bolling Air Force Base in Washington, D.C.

Now, I'd like to introduce the other members of the panel tonight.

Lt. Col. Gary Baumgartel is the Chief of the Environmental Planning Division at the Air Force Center for Environmental Excellence in San Antonio.

Lt. Col. Gary Bleeker is from the Phillips Laboratory at Kirtland Air Force Base, New Mexico.

Now, Col. Baumgartel will describe the environmental impact analysis process and the results of the environmental analysis. Col. Bleeker will brief you on the proposed action and the alternatives for the program.

Now, also with us, to my immediate left, is Mr. John Leppert from the Department of Energy's Field Office here in Nevada. The Department of Energy is a

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cooperating agency in this program and has participated in the preparation of this Draft Environmental Impact Statement. Mr. Leppert will answer questions that you may have concerning Department of Energy's involvement with this program.

Let me stop right now and say, we've got some people here with signs, and that's fine. But you need to take the signs to the back of the room. We don't mind you being here -- or if you want to put them down, I don't care which, but I just don't want it to interfere with the process. If you want them up you can go ahead and have them up along the back railing, or you can hold them up along the back railing. But the sign down here, for instance, you need to put that -- thanks a lot. I appreciate your cooperation.

Now, what I was indicating, Mr. Leppert will answer questions that you may have concerning the Department of Energy's involvement with this program.

Now, as the presiding officer for this hearing, I'm not acting as a legal advisor to the Air Force representatives who will address the action, and I'm not here as an authority on Draft EIS. I've not had any involvement with its development.

My purpose here tonight is to insure that we have an orderly hearing, and that everyone who wishes to

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provide input or to make a comment or to ask clarifying questions has a fair opportunity to speak and to be heard.

Now, I'd like to explain the public hearing process and the procedures that we'll follow this evening. The Air Force has prepared a Draft Environmental Impact Statement, or Draft EIS, you'll hear it referred to, on the Space Nuclear Thermal Propulsion Program. That was done in accordance with the National Environmental Policy Act and Air Force implementing regulations.

The purpose for this hearing is to summarize for you the results of that Draft EIS and receive your comments on the Draft EIS.

We can go to the next slide, please.

Now, tonight's hearing will be in two parts. During the first part, Lt. Colonels Baumgartel and Bleeker will present information to you concerning the environmental impact analysis process performed for the Space Nuclear Thermal Propulsion Program.

The second part of the hearing is the public participation portion, where you will have the opportunity to comment on the Draft Environmental Impact Statement or to ask clarifying questions.

Now, this hearing is intended to provide a public forum for two-way communication about the Draft EIS, with a view towards improving the decision-making process.

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Your inputs ensures that the decision makers may benefit from your knowledge of the local area and any adverse environmental effects that you think may result from the proposed action or the alternatives to that action.

Let me say what this hearing is not. This hearing is not a debate, nor a referendum. It's not a vote on the actions that have been analyzed by Draft EIS. The focus on the hearing is for the purpose of the environmental analysis, environmental impacts associated with the proposals being studied by the Air Force, comments -- we solicit comments, particularly on the environmental aspects. Comments not on the environmental issues should not be raised at this hearing.

It's also important to announce that none of the people up here on the stage are the decision makers on this project.

Now, when you came in tonight you were provided with an attendance card, like the one I'm holding up here. You were asked to indicate on it if you wished to speak tonight. Now, after the presentations by Col. Baumgartel and Col. Bleeker, we'll take a short break, about a fifteen-minute break. Following that break you will have a five-minute opportunity to speak or to ask clarifying questions, or both.

Elected public officials will be given an

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opportunity to speak first, followed by the public at large.

Now, I'll randomly call on members of the public at large, using these cards. So if you have not had an opportunity to fill out a card, or if you did not check the block indicating that you wanted to speak, and that during the presentation you decide you do want to speak, if you'd raise your hand and we'll get a card to you, or if you fill out a card and still have it with you, just raise it up and we'll get someone to pick it up so that you'll be included.

And what I'll do is, when we get into the public portion of this input, I'll take and just shuffle these cards up so that we've got a random opportunity for everyone to be heard.

Now, if you don't make an oral statement tonight, but you would like to provide your input, you may do so in writing. And for your convenience you may have noticed the written comment sheets that were laying out on the registration table. They also list the address to which inputs, whether it's using this sheet or whether it's using the other written documentary materials that you want to provide, just send it to the address listed at the bottom of the sheet.

Any comments that are made tonight or, whether they be oral or whether they be in writing, or comments that are submitted later, will be given equal consideration in

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the decision-making process.

But if you want your comments to be included in the record and considered in this process, you must either provide your comments tonight or send them to the address shown at the bottom of the sheet by October 5th of this year.

And if you speak tonight or provide some kind of input, you can still provide further input, sending it to the address that we've listed.

In summary, I'd like to stress that this is your opportunity to provide the Air Force with any information you may have regarding environmental factors that are unknown to us and to have input into the decisions that the Air Force must make regarding the proposed actions.

At this time Lt. Col. Gary Baumgartel will describe the environmental process. Lt. Col. Baumgartel.

LT. COL. BAUMGARTEL: Thank you, Col. Ruepel. Good evening. I'm Lt. Col. Gary Baumgartel from the Air Force Center for Environmental Excellence at Brooks Air Force Base in Texas. Our organization is independently conducting the environmental impact analysis process for the Space Nuclear Thermal Propulsion Program.

Tonight I will present the schedule for completing this environmental impact analysis process, and show how the present public comment period fits into this

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schedule. I'll also discuss the scope of the study, and Lt. Col Gary Bleeker, on my left, will then present a briefing on the proposed action and the test location alternatives.

Lastly, I will present the results of our analysis.

On March 13, 1992 the Notice of Intent to Prepare an Environmental Impact Statement, which I may refer to as EIS, for the Space Nuclear Thermal Propulsion Program was published in the Federal Register.

Four scoping meetings were held in April, 1992 to receive comments from the public concerning the scope of issues to be addressed in the Environmental Impact Statement, or EIS.

After scoping, we collected the necessary data and conducted the analysis. The Draft Environmental Impact Statement we are here to discuss tonight was filed with the United States Environmental Protection Agency on August 14, of this year.

The public comment period will extend until October 5, 1992. The final EIS is scheduled to be completed in December of this year. Once complete, this EIS will be used by the Air Force to decide whether or not to proceed with a test program to validate the concept behind the nuclear propulsion program. We expect to accomplish the record of decision in January, 1993.

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A copy of the Draft EIS was mailed to all groups and individuals who requested one. In addition, these libraries shown in the state have a copy available for review. Also, a copy may be requested tonight or by writing to this address at the bottom.

Next slide, please.

In addition to tonight's hearing, written comments on the Draft Environmental Impact Statement will continue to be accepted at this address until October 5, 1992. After the comment period is over, we will evaluate all comments, both written and oral, and perform additional analysis or change the Environmental Impact Statement where necessary.

Again, as in the scoping process, equal consideration will be given to all comments, whether they are presented here tonight or received prior to October 5, 1992. Comments received after October 5th may not be considered in the final Environmental Impact Statement because of schedule constraints.

Once the review process is complete, we will produce the final Environmental Impact Statement and mail it to all those on the original Draft Environmental Impact Statement distribution list, as well as those who request a copy between now and the mailing date.

The final Environmental Impact Statement will

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include comments received during the public review period and our responses to those comments.

Following completion of the EIS, the Air Force and DOE will consider Environmental Impacts, as well as other factors, such as economic and technical considerations and program goals, before deciding whether to proceed with the SNTP program. The decision will be documented in a record of decision.

Now, I would like to present Lt. Col. Bleeker from the Phillips Laboratory, who will describe the Air Force's proposed plan for the Space Nuclear Thermal Propulsion Program.

LT. COL. BLEEKER: Thank you.

Good evening, ladies and gentlemen. I'm Gary Bleeker. I'm the program manager for the Space Nuclear Thermal Propulsion Program at the Air Force's Phillips Laboratory in Kirtland, New Mexico.

Tonight I'd like to tell you about the Space Nuclear Thermal Propulsion Program and our proposal to develop and to validate the particle bed reactor propulsion technology.

The SNTP's program mission is to develop and to validate nuclear reactor technologies with potential application to advanced space propulsion systems. Several propulsion technologies have been and continue to be

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considered as viable research options. However, the Air Force considers the particle bed reactor propulsion technology to have sufficient developmental potential to warrant continued investigation.

Before we go any further, I'd like to explain how the SNTP program was formed. Approximately two years ago work was begun on an Environmental Impact Statement to support certain decisions concerning a classified program, and particle bed reactor technology was one of the state-of-the-art technologies being developed under this program.

However, because the program was classified, the EIS was likewise classified, and it was prepared without public participation. Because of changing mission requirements, the program, Code named Timberwind, was terminated.

The Air Force, recognizing the potential of the particle bed reactor concept, took over the responsibility for developing the particle bed reactor.

The SNTP program office was formed in 1991 to lead and to manage the developmental effort. In assuming this responsibility, the Air Force determined that rather than to rely on the classified EIS, about which the public knew nothing, we would prepare a new EIS for the program with full public participation.

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In short, the Air Force wants to fully develop and validate the particle bed reactor technology that was started under the Timberwind Program. The Air Force goal is to demonstrate the feasibility of a PBR propulsion system that could be operated outside the atmosphere in space as an advanced upper stage or as an orbital transfer vehicle.

As stated in the Notice of Intent, the decisions to be made, based in part on the this EIS, are:

A. Whether to continue the SNTP program through the development of nuclear thermal propulsion technology.

B. Whether to construct and operate a validation test facility. And

C. Where to locate the validation test facility if the program is to continue.

Two sites are being considered for location validity test facility, and both were studied in the Environmental Impact Statement. One is at the Nevada Test Site, and the other is at the Idaho National Engineering Laboratory.

When this environmental analysis was begun, a third site called "Quest", also at the Idaho National Engineering Laboratory, was also under consideration. However, as a result of our investigations, it was eliminated from further consideration due to the presence of

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significant cultural resources.

Before we get into the details of the program and specifics of our proposed action, I'd like to provide a lay person's description of conventional chemical and nuclear propulsion systems and why the promise of nuclear propulsion is so profound.

First, the ultimate objective of any propulsion system is to produce very hot gas for propulsion, indicated down at the bottom.

In a conventional chemical propulsion system, over on the left, two fluids, both a fuel and an oxidizer, are mixed and they are burned. When proper combustion occurs, up in this area, a large volume of hot gas is generated. The hot gas is expanded through a nozzle to produce thrust.

However, there are but a few acceptable fuel and oxidizer combinations. The efficiency and performance of chemical propulsion systems are limited by both temperature and the molecular weight of the gas after the combustion process is complete.

A nuclear propulsion system, indicated on the right, contains a reactor, 7 at the top, which replaces the combustion process in a conventional propulsion system.

Thus, the reactor essentially becomes a very powerful heater, heating a single fluid, which is the

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propellant in this case, to very high temperatures. The propellant flows through the reactor, becomes very hot, is expanded through a nozzle and produces thrust in the same manner as a conventional rocket.

Both chemical and nuclear propulsion system temperatures are limited by the material capabilities, which limit operating temperature to about 5,000 degrees Fahrenheit.

But the key difference between the two is that with a nuclear propulsion system we can choose the propellant. By choosing the lightest propellant, hydrogen, a nuclear propulsion system can be made more than twice as efficient as a conventional one.

While that is a very significant result, its effects are even more dramatic because propulsive efficiencies work in a very special way. The theoretical effect of doubling the propulsive efficiency is that load-carrying capacities could be increased by 8 to 10 times.

However, as a practical matter, we can see real cost and weight reduction by a factor of 2 to 5. This means a tremendous monetary savings if a safe, high performance nuclear propulsion system can be developed.

One nuclear technology, called Particle Bed Reactor, or PBR, is viewed by the Air Force and others

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as having distinct performance advantages.

The PBR would use spherical fuel particles, indicated on the left. A typical fuel element would contain many millions of these fuel particles, each approximately 1/2 millimeter in diameter. A typical particle contains a kernel, in the center, of fully enriched uranium-235, surrounded by a porous graphite buffer layer. There are several layers you can see here. Next is a high-density graphite layer, which is surrounded by a final layer of zirconium carbide.

These multiple coatings provide containment of fission products and prevent the heated hydrogen from damaging the kernel material.

Each hexagonal fuel element -- this whole thing is the fuel element -- includes neutron moderator material, which is on the outside, a set of concentric frits, or filters, and the fuel particles, in the middle there. The concentric frits are devices that structurally support the fuel particles while allowing hydrogen to flow through the material and cool the fuel particles. Flow paths through an element are illustrated in the figure, these arrows you see through here.

The entire fuel element assembly would be surrounded by a neutron reflector, such as graphite or beryllium, to enhance reactor performance. The PBR

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configuration under consideration consists of a closely packed array of hexagonal fuel elements, surrounded by neutron moderating and reflector materials and reactor control devices.

The use of an array of hexagonal fuel elements allows the option of a modular design, where the number of elements used would be tailored to produce the desired thrust.

The general concept involves the use of the particle bed reactor to heat low temperature liquid hydrogen propellant to very-high-temperature gaseous hydrogen. The hot hydrogen is not burned, but simply exhausted through a nozzle to produce thrust.

The major goals of the SNTP program include the achievement and control of predicted nuclear power levels, the development of materials that can withstand the extremely high operating temperatures and hydrogen flow environments, and the reliable control of low- and high-temperature hydrogen propellant.

In addition to the particle bed reactor itself, the principal components of a conceptual PBR system are the propellant management system, which is in this area, and the pressure vessel/nozzle assembly, which is down through here in the nozzle.

The propellant management system provides

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controlled flow and pressure to the reactor and any other subsystems. The propellant management system also contains provisions for tank pressurization and conditioning of fluid paths. During operation, low temperature hydrogen exits the propellant tank and enters the pump section, which you see up here.

After exiting the pump, the propellant is delivered to the reactor, in that area, where it is heated to the desired temperature. A small portion of the propellant is bled off to power the turbopump and the balance is subsequently expanded through the nozzle.

The pressure vessel/nozzle assembly would also provide pressure containment and structural support -- in other words, the casing here -- and collect the hydrogen gas from each reactor fuel element and accelerate the gas through the throat section of the nozzle to generate thrust.

This leads to the description of the proposed validation testing of the PBR propulsion technology. The proposed testing would demonstrate the technology through a series of tests over a 5- to 10-year period leading to the validation of the PBR concept.

As shown in this slide, the tests are sequenced to begin with fuel element testing and culminate in testing of the integrated systems. Specifically, the test series includes the PBR integral performance element test (PIPET)

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and the engine integration tests (EIT) as well as tests of ground test articles. All these tests would involve reactors fixed within a test cell and within properly contained facilities.

Each test series would be carefully planned to include written procedures and formal review and approval. Each test sequence would undergo a comprehensive safety analysis before approval to proceed could be granted.

The multiple fuel element tests, or what we call PIPET, would be the first self-sustained, power-producing PBR test. These tests would involve a reactor about the size of a 55-gallon drum, and would be used to demonstrate the performance, operability and reliability of those fuel elements developed for the SNTP program.

Each of the nuclear cores involved in these tests could be subjected to five operating cycles at a maximum power level of 550 megawatts for as long as 500 seconds per cycle. This is the energy equivalent of a Boeing 747 flying for 40 minutes. Up to ten of these tests may be conducted in a year.

Non-nuclear turbopump tests, or what we call engine integration tests, would be designed to demonstrate proper function of the propellant management system without an operating reactor in the loop. A mock-up of the entire system would be tested using a gas generator system to

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produce hot hydrogen to power the turbopump for system checkout. The EIT series would establish confidence in the control and in the feed system necessary to allow proceeding to the GTA engine system tests.

The integrated system tests, or what we call GTAs, would be a series of up to ten reactors which gradually approach the desired performance conditions. GTA design would evolve from technical information derived during the PIPET and other program testing.

GTA tests would, through a progressively expanding test program, expose the system to the full performance profile values of temperature, pressure, flow rate, and nuclear radiation fields. Two versions of these GTAs would be tested. They are referred to as mini-GTAs and full-scale GTAs.

Mini-GTAs would be sub-scale versions of the larger GTA. Subsequent to satisfactory operations associated with those PIPET, mini-GTAs would be tested in the same sub-scale test cell used for PIPET.

The mini-GTA reactors would be designed to more closely represent a full-size GTA fuel element. The full-scale GTA test series would demonstrate a complete particle bed reactor operation with feed and control hardware and a full complement of instrumentation. The full-scale system would be approximately the size of a small

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automobile.

Multiple tests would be performed on each of the full-scale GTAs. The tests would build up from zero power, to low power, to operational power and temperatures. These tests would demonstrate controllability and stability at full power and the rapid start-up and shutdown under computer control over a simulated full mission profile.

Each test would be in the order of a few minutes in duration. The maximum time at full reactor power for any individual core assembly of the GTA test series would be approximately 1,000 seconds. The energy produced from such a test would be equivalent to a Boeing 747 flying for approximately four and a half hours.

Because no facility exists that fully meets testing requirements, construction of a new test facility or extensive modification of an existing facility is required.

Construction or modification of facilities would be phased to provide a sub-scale facility to accommodate the initial testing. The sub-scale facility would include only a single test cell for the PIPET and the mini-GTA test reactors as well as the supporting infrastructure. Sub-scale testing would include less than 50 tests over a period of 3 or 4 years. Approximately five tests would be run on each set of the fuel elements to be tested.

If the sub-scale testing proves successful, the

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sub-scale facility would be expanded to provide a full-scale facility necessary to complete the full-scale GTA testing. The full-scale test facility would be designed to accommodate a GTA test reactor with a capacity of 2,000 megawatts. It is estimated that up to ten GTA test series would be run.

As shown on this slide, the main features of a sub-scale facility would include a control complex including an instrumentation and control system, a test cell, a confinement system, a coolant supply system and an effluent treatment system.

The control complex would be a shielded, reinforced concrete building from which access to the test facility, activities involving the test cell, and a system to provide video surveillance over the entire test facility would be controlled.

The control system would provide the required safety and control functions for all operations at the test facility. The system would provide remote control of all functions associated with the test systems.

In addition, it would give a visual indication of critical system parameters and process status to assure safe operation during all phases of the experimental programs.

The sub-scale facility would also include a test

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cell to accommodate the major components of the reactor for initial PBR validation tests.

The confinement system would be provided to limit the release of fission products and would include a barrier, including the reactor and portions of the effluent treatment systems.

The process fluid systems for the sub- and full-scale test facilities would consist of two major sub-systems: The coolant supply system, and the effluent treatment system.

The coolant supply system would be composed of the hydrogen storage system, the helium storage system, and the pipes and the valves for the coolant distribution.

There are three major reasons for incorporating an effluent treatment system into the test facility.

First, one of the goals of PIPET testing is to validate design margins. The potential for releasing a larger quantity of fission products increases as the operating parameters approach these limits.

The emissions of radionuclides into the ambient air from DOE facilities are regulated by the EPA in accordance with the National Emission Standards for Hazardous Air Pollutants, which specifies that the emissions shall not exceed an amount that would cause any member of the public to receive, in any year, an effective dose

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equivalent of 10 millíroentgen equivalent man, or millirems, per year.

While the National Emission Standards may allow a member of the public to receive a dose of 10 millirems in a year, the SNTP program would be committed to a design goal of 2 millirems per year, or 20 percent of the allowable regulatory limit.

Second, because the SNTP program is a developmental program, there would be some uncertainty in the actual composition of the effluent. And ETS, or effluent treatment system, would ensure that the emissions from planned activities would remain within the program goals under all postulated routine operating scenarios.

Third, it is a national policy to reduce radioactive discharges to a level that is as low as reasonably achievable.

The ETS would be designed to accomplish the following objectives:

1. Ensure that radioactive material entering the ETS remains in a sub-critical geometry.
2. Cool the test article effluent to temperatures acceptable for normal engineering materials used in gas treatment systems.

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3. Remove particulates, debris, halogens, noble gases and vapor phase contaminants from the effluent stream. And
4. Flare the resulting hydrogen gas to the atmosphere to prevent the accumulation and potential detonation of the hydrogen in the vicinity of the test cell.

An effluent monitoring system would measure the radioactive and particulate content of the discharge stream on a real-time basis. This would alert the operator to releases of radioactivity and/or approaching prescribed limits.

The ETS design would include appropriate shielding to prevent worker exposure to ionizing radiation above acceptable levels.

Construction and/or modification of all facilities is expected to take approximately 18 to 24 months for both the sub-scale and full-scale test facilities, with an average work force of about 35 and a peak work force of about 100.

The number of personnel on site during pre-operation activities at the sub-scale facility would be limited to about 30 security, technical, administrative and maintenance personnel. The pre-operational staff of the

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full-scale facility would be approximately 50 to 60. During actual testing operations for both facilities, the number of personnel on site would be reduced to a minimum operating staff of no more than 10 individuals, all located within the control complex.

The resulting population increase in the region would be approximately 70 as a result of sub-scale operations and 120 as a result of full-scale operations.

Two sites at Department of Energy installations have been identified as suitable locations for the PBR validation test facility: The Saddle Mountain Test Station at the Nevada Test Site and the Contained Test Facility site at Idaho National Engineering Laboratory.

The principal exclusionary criteria considered in the site-narrowing process were:

1. Similar nuclear activities conducted at the installation.
2. Fifteen kilometers minimum distance to the nearest urban area. And
3. Federal ownership of the facility.

Both of the Department of Energy installations have sufficient infrastructure support. The Saddle Mountain site would require new construction for all facilities and extension or improvement of roads and utilities. The Contained Test Facility in Idaho has existing facilities and

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infrastructure but would require some modifications to existing facilities as well as some new construction.

The Saddle Mountain Test Station is located in the center of Nevada Test Site, south of Nine Mountain Road and west of Saddle Mountain Road. The distance to the nearest boundary is 14 miles, and access to the Nevada Test Site is controlled.

Saddle Mountain Test Site would require new construction for both sub-scale and full-scale test facilities. Other infrastructure required for the site includes power lines, phone lines, roads, a deep water well, and water storage tanks. Transportation improvements include new site roads and the grading of the existing access roads.

The contained test facility is located in the northern portion of INEL, northeast of the intersection of Lincoln Boulevard and State Highway 33, which in this area.

Some existing facilities to support PBR validation testing are already located at the Contained Test Facility site.

Existing facilities at the site consist of a receiving, assembly and hot cell facility, a containment structure, a control bunker, post-irradiation examination facilities and administrative space.

An approximately one and a half mile railroad

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track connects the containment structure to the receiving, assembly and hot cell facility. A security fence with guard stations is also in place.

A number of modifications to the existing facility would be required. It is likely that the control building would have to be reconfigured to accommodate the tests, and the receiving, assembly and hot cell facility may require modest modification to accommodate the hot test articles.

Engineering studies have been initiated to determine if the Contained Test Facility or new test cells would be required for the full-scale test. New test cells, if required, could be located adjacent to the Contained Test Facility.

Use of the Contained Test Facility containment structure as the test cell would require construction of process fluids storage and piping, the effluent treatment system and the flare stack. Engineering studies are underway to determine renovation requirements for the Contained Test Facility vessel.

As required by the National Environmental Policy Act, the no-action alternative was also evaluated. The no-action alternative would result in the Air Force not proceeding with the PBR development and the validation testing program.

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What I have presented here is a summary of our proposal to develop and validate the PBR propulsion technology. Many more details of the proposed action are contained in the Draft Environmental Impact Statement.

Lt. Col. Baumgartel will next present the environmental impact analysis for this program.

LT. COL. BAUMGARTEL: This Draft Environmental Impact Statement was prepared to comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Efforts were made to reduce needless bulk, write in plain language, focus only on those issues that are clearly related to the environment, and to integrate the EIS with other documents required as part of the decision-making process.

The analysis focused on impacts to the natural environment that may occur as a direct result of the particle bed reactor development and validation testing, or indirectly through changes in the community.

Resources evaluated are air quality, biological resources, cultural resources, soils and geology, noise, water, both surface and groundwater.

Indirect changes to the community that provide measures against which environmental impacts could be analyzed included changes to the local employment and population, land use and aesthetics, transportation, and

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utility services.

In addition, issues related to current and future management of hazardous materials and waste are discussed in the document. Because the proposed action involves transportation and testing of nuclear materials, a considerable amount of health and safety analysis was done to address radiological as well as non-radiological impacts.

If, as a result of our analysis, it was determined that adverse environmental impacts may occur through implementation of the proposed action and testing alternatives, then potential mitigation measures were identified and analyzed in the document.

I would now like to present the results of our analysis that are presented in the Draft EIS. Both validation test site locations were analyzed to the same level of detail. The baseline conditions assumed for the purpose of analysis are the existing conditions at each location. The following slides show the comparative impacts between the test site alternatives, excluding the no-action alternative.

Next slide.

This slide shows the maximum projected population and employment effects from the implementation of the SNTP program. A peak year increase of 100 employees, assuming for purposes of determining maximum impact, that no

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persons from the local job market would be employed, results in a 0.04 percent population increase in the region of influence for SNTS, or a 0.2 percent, or two-tenths of a percent, increase in the region of influence for CTF. A maximum of 2 percent increase in total peak year employment would occur at the NTS, or a 1 percent increase at the INEL.

This slide shows the utility requirements for the SNTP program at the two alternative test sites.

Under energy, there is sufficient power at both SNTS and CTF for sub-scale testing. Supplemental power would be provided by mobile generators at the SNTS during ground test article operational testing. Mobile generators may be required to provide supplemental power during the peak demands of ground test article operation testing at the CTF site, also.

Under solid waste, an average of 175 tons per year of non-hazardous waste is expected from the SNTP program. At the NTS this is less than 2 percent of the total amount of solid waste generated, and would result in a negligible decrease in the anticipated life of the disposal capacity.

At the INEL, a new landfill will be operational by 1995. Therefore, a negligible impact on landfill capacity is expected.

Under wastewater, at the SNTS, the total

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estimate of 2,400 gallons per day of wastewater would be handled by a new septic system planned for the SNTP facility design. An additional 2,400 gallons per day of wastewater at the CTF would be within the capacity of the existing evaporation pond system.

Under water supply, the 0.01 million gallons per day of water demand for the SNTP represents a small increase in demand on the water supply systems at either the NTS or at the INEL.

The construction of facilities on 100- acres at the SNTS is consistent with current missions and activities at the NTS, and no land use impacts would occur. The modification of existing facilities and construction of additional facilities at the CTF is consistent with current mission and activities at the INEL, and no land use impacts would occur.

This slide shows the traffic impacts of increased employees travelling to either NTS or INEL. A maximum of 5.8 percent increase in traffic is expected along U. S. 95 to NTS for construction and a maximum of only 3.5 percent increase during operations.

Assuming that most employees at INEL would use commuter buses to get to work, the SNTP program would cause a 4 percent increase in traffic during construction and a 3 percent increase during operations on State Route 33. None

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of these traffic increases is expected to cause adverse impacts to levels of service for these roads.

The next two slides cover the transportation and use of radioactive and non-radioactive hazardous materials, and the storage and disposal of hazardous wastes. Health and safety aspects of hazardous materials and wastes will be discussed shortly.

Under hazardous materials, the largest quantity of fuel material to be transported in a single shipment would be the reactor cores. The Department of Transportation, the Department of Energy, and Nuclear Regulatory Commission regulations and requirements would be followed to ensure that no adverse impact from these and other transportation activities. Also, these precautions would be required for either the SNTS or the CTF sites.

Under the non-radioactive hazardous waste, approximately 500 cubic feet, or seventy 55-gallon drums, of non-radioactive hazardous waste, consisting principally of solvents, would be generated from either site over the life of the program. All waste would be labelled and shipped to an EPA-permitted treatment, storage and disposal facility.

Under low level waste, low level radioactive waste requiring disposal would consist of solid wastes from the handling, cleaning and disassembling of canister assemblies and contaminants removed from the effluent

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stream.

Over the life of the project, it is anticipated that 1.6 million cubic feet of low level waste would be generated. This low level waste would consume 18 percent of the available disposal capacity at NTS, or 46 percent of the available disposal capacity at INEL.

Under mixed waste, mixed waste, such as low level radioactive materials contaminated by solvents or solvent residues may be generated. It is anticipated that no more than 70 cubic feet of mixed waste material would be generated annually.

NTS has sufficient capacity for storage and disposal. INEL has sufficient capacity for storage, and is awaiting permitting for a disposal facility.

The disturbance of ground and construction of facilities at SNTS or at CTF generates some fugitive dust, which is regulated under the National Ambient Air Quality standards as particulate matter, and there would be emissions from construction vehicles, also.

Emissions from the operational phase would include emissions from additional traffic and from minor site activities, such as the use of diesel generators and the flaring of hydrogen during particle bed reactor tests.

The impact on regional and local air quality from either the SNTS or the CTF alternative would be

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negligible and is not expected to affect the attainment status of the region.

This slide summarizes the impacts to biological resources from the project at the two alternative sites.

At the SNTS, there would be a loss of 100 acres of Transitional Desert Association Habitat, which is a common community. Construction of the facilities and improvements to the access road may impact up to 1,000 Joshua trees.

From project operations, noise may affect wildlife, and the flare stack would kill any birds flying into the flame. However, noise from the flaring would very likely scare the birds away that might fly over the flare stack area. No impacts to the threatened or endangered species are expected.

At the CTF, there would be a loss of less than 50 acres of previously disturbed land that is low quality habitat. Project operations, that is, noise and the flare stack, would have similar impacts as at the SNTS.

The only threatened and endangered species, the bald eagle, has been observed approximately 12 miles from the CTF and foraging near the mountains north and west of INEL. The only possible impact would be from the flare stack, and this is considered unlikely because of the distance, noise from the flaring operation, and the

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intermittent nature of the flaring operation itself.

This slide summarizes the results of the cultural resources analysis for the two alternatives.

At SNTS, seven prehistoric sites were found within the region of influence. None of these sites is considered significant under the National Register criteria. Therefore, no adverse impacts are expected to occur to archeological resources. No historic, native American or paleontological resources have been identified at the SNTS.

At the CTF, the only known cultural resource that may be affected is the existing facility at the CTF, which retains qualities that would make it potentially eligible for the National Register of Historic Places. This is because the CTF is the only nuclear reactor test facility of its size in the world designed to simulate all of the important events that could occur in a commercial pressurized water reactor power plant.

Consultation between the Idaho State Historic Preservation Office, the Advisory Council on Historic Preservation, and INEL is addressing the issue of National Register eligibility for several INEL properties. A memorandum of agreement to outline various mitigative requirements is currently being prepared.

Until the consultation process determines the eligibility of the CTF for the National Register, it will be

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considered a potentially significant historic resource. As such, modifications proposed by the SNTP would have an adverse effect.

Mitigation measures may be required if this site alternative is chosen. If it is determined that the CTF is not eligible for the National Register, then no cultural impacts are expected at the site.

Under geology and soils, the construction of the new facilities would require disturbance of 100 acres of land for the SNTS, or less than 50 acres for the CTF. The SNTS would require 28,000 cubic yards of material for cut and 37,000 yards of material for fill, while the CTF would require only 3,000 yards for cut and 4,000 yards for the fill operation.

Measures would be taken at either site to suppress dust and soil erosion. No impacts from seismic or volcanic activity are expected at either site.

High noise levels at SNTS are not expected to cause impacts to non-project personnel. The projected 125-decibel noise level from operations would be attenuated before reaching non-project personnel and sensitive community receptors. The nearest non-project personnel would be approximately six miles away, and the nearest community is approximately 23 miles away.

Noise levels at CTF are also not expected to

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impact non-project personnel and sensitive community receptors. The nearest non-project personnel are approximately 1.3 miles away from the CTF and the nearest community is approximately 11 miles away.

There would be short term noise effect on wildlife in the immediate vicinity of the test facility during test operations. This may have a beneficial side effect of scaring birds away from the flare stack.

The 3.7 million gallons per year of water required for the project are not expected to cause drawdown in the aquifers at either the SNTS or the CTF. No water quality impacts are expected from normal operations.

Under health and safety, this slide is a chart showing results from maximum case radiological modeling of normal testing operations as compared to the National Emission standards, the program goal, and the radiation dose we receive naturally.

In summary, the SNTP program exposures to the maximally exposed public are much smaller than the annual regulatory limit for routine exposures. These calculated exposures are also considerably smaller than the annual exposure through naturally occurring radiation.

For the NTS area, the maximum single year exposure would be 0.6 millirem, which is 0.14 percent of the naturally occurring exposure. For the INEL area, the

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maximum single year exposure would be 1.35 millirem, which is 0.31 percent of the naturally occurring exposure.

These doses represent upper bounds on the potential exposures and have been calculated using extremely conservative methodology. In summary, no adverse radiological impacts are expected as a result of the proposed action.

This slide shows the results from radiological modeling of the maximum case credible accident scenario. The maximum case credible accident is assumed to consist of the simultaneous failure of two critical ETS components, resulting in a release to the environment.

In developing the maximum case effects shown here, all weather conditions were looked at and consideration was given to multiple concurrent internal and external explosions of hydrogen.

The maximum credible accident exposure at NTS would be 23.5 millirems, or 5.6 percent of the natural dose. The maximum credible accident exposure at INEL would be 30 millirems, or 6.8 percent of the natural dose.

In comparison, the recommended maximum 24-hour accident exposure level is 500 millirems, or more than 15 times the maximum accident exposure at either site.

As with normal operations exposures, the maximum accident exposures represent the upper bounds, using

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extremely conservative methodology. Also, the analysis does not include mitigation measures such as evacuation and remediation which would be undertaken in the event of an actual accident.

Looking at worker exposures, the Department of Energy suggests a design goal of a maximum 500 millirems annual dose for radiation workers. The 150 workers at the SNTP facility could, therefore, be exposed to as much as 750,000 person-millirems over the ten years of the SNTP program and meet this goal.

Also, the goal of the SNTP program is to maintain exposures to on-site non-program related personnel to a much lower level of only 20 millirems per year.

Based on this goal, the 4,500 workers at NTS could receive up to 900,000 person millirems, only a 4.7 percent increase over the natural exposure levels of 19 million person-millirems which would be received during the ten-year period of the SNTP program.

The 8,500 workers at the INEL would receive not more than 1.7 million person-millirems, or only a 4.5 percent increase over the natural exposure levels of 37.5 million person-millirems during the ten years of the SNTP program.

In the area of chemical safety, the SNTP program would use several liquid and gaseous chemicals in support of

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the program. Hydrogen is classified as a simple asphyxiant. Its greatest hazard is from its extreme flammability range, which can lead to fires or explosions.

Oxygen, although not flammable itself, supports and accelerates combustion. Nitrogen and helium are simple asphyxiants and non-reactive.

Numerous facility designs and handling procedures would be established to ensure that these hazards are minimized when using these chemicals. These designs and procedures will be implemented to ensure the hazards are minimized.

There are no site specific issues with the SNTS site in terms of chemical safety.

Use of the CTF for testing purposes may allow the build-up of hydrogen inside the facility during test operations. Following test completions, venting of the structure would be required before personnel could enter, to reduce the potential of explosion or asphyxiation.

AN UNIDENTIFIED WOMAN: What did you say?

LT. COL. BAUMGARTEL: Excuse me?

AN UNIDENTIFIED MAN: Repeat the last sentence.

AN UNIDENTIFIED WOMAN: Would you repeat that last statement?

LT. COL. BAUMGARTEL: The CTF facility would tend to have a build-up of hydrogen in the facility and it

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would be ventilated prior to personnel entering the facility to prevent explosion or asphyxiation of the people from entering into the building.

Several analyses were performed that considered potential impacts from the transportation of radioactive materials.

For the non-accident case transportation of radioactive materials to the NTS, the calculated total population dose received for the program duration would be 113,000 person-millirems.

In addition, only 0.94 person-millirems are projected as a result of anticipated transportation accidents. For non-accident transportation of radioactive materials to INEL, the calculated total population dose for the program duration would be 132,000 person-millirems, with up to an additional 1 person-millirem projected as a result of anticipated transportation accidents.

In all cases, the population dose would be distributed among the total population, with no member of the public receiving a dose in excess of 1 millirem, and the majority of exposed individuals receiving a total dose which is immeasurably low.

Beryllium is under consideration for use in the particle bed reactor. Inhalation of beryllium particles may lead to bronchitis and pneumonia, and it is a suspected

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carcinogen. The only likely release of beryllium would be from a catastrophic failure. However, no credible accident scenario is conceivable that could produce considerable amounts of beryllium.

Based on a maximum case release, the total exposure to any individual would be no greater than three ten-thousandths of a milligram. This exposure would be more than 50 times less than the Occupational Safety and Health Administration permissible exposure limit of 173 ten-thousandths of a milligram in a 24-hour period. Therefore, beryllium release is not expected to be a significant impact under any circumstances.

This concludes my review of the Draft EIS. Our goal is to provide the Air Force decision-makers with accurate information on the environmental consequences of this proposal. To do this, we are soliciting your comments on the draft tonight.

Now, I'd like to turn the meeting back over to Col. Huepel.

COL. HUEPEL: Some of you came in after our preliminary pop-ins. There is a card. If you have not filled out one of the cards at the registration table, if you want to make comments, we'll be taking a break in just a moment, and I would ask you to go ahead and fill out a card and mark if you would like to make comments or if you have

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some clarifying questions that you want to ask, indicate that, and we will collect those cards and we'll call on speakers in a random fashion.

If you haven't found them, the rest rooms are down to the right as you go out these doors. I don't know where else in the hotel here there's rest rooms, but we're going to take a 15-minute break and we'll come back in in 15 minutes.

(A recess was had.)

COL. HUEPEL: Let me go through the procedures that we'll be following during this portion. If you wish to speak but haven't filled out a card, if you will raise your hand we'll get a card to you so that you can fill it out and they will be brought to me to put into the stack here. Don't be shy or hesitant about making a statement. I want to make sure that everyone who desires to speak tonight will have a fair chance to be heard.

Now, we do have a reporter who is taking down word for word everything that is said during the hearing. This record will then become a part of the final environmental impact statement and the decision package.

Now, I have mentioned the final environmental impact statement. You have already heard the comments of Colonel Baumgartel and Colonel Bleeker earlier. Based on the draft environmental impact statement, let me just point

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out again that that document is available for public reading at the libraries listed on the screen.

Now, during this portion of the hearing I ask you to follow these ground rules. I will announce the name of the first speaker, and then also the name of the second speaker. While the first speaker is at the microphone, the second speaker should be coming up, and we've got a chair down here in front by this gentleman with the white T-shirt on, there on the front seat.

If you just go ahead and come on up here so that you're here at the podium so that when the first speaker is done, you can go ahead and get up. And while you are getting up, I will announce the next speaker. And that way, hopefully, we can conserve time and get as many speakers in as possible.

Secondly, if you'd please speak only after I recognize you. And if you'd address your remarks to me as the hearing officer. If you have any written statements that you have to submit or any written documents you want to be considered, there's a basket on the podium for that purpose.

I'd ask you to please speak slowly, clearly, speak into the microphone, so that everyone has an opportunity to hear.

Please indicate your name and what city you are

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from and the capacity in which you are speaking. By that, I mean whether you are an elected public official or whether you are representing some group or whether you are speaking as a citizen in your own right.

Fourth, I would recognize each person for five minutes so that everyone has an equal opportunity to be heard. We do have a large number of speakers, so it's important to observe this. When we get to the five minutes, I am going to the raise my hand up. I will be doing the timing so I will raise my hand and ask you to conclude your remarks.

If you have more comments than you will be able to present in five minutes, I'd ask you to priortize your comments, and also recall that you can send in additional written comments as well as your oral comments here tonight.

If I call the name of someone who is not in the room I will hold that card until just before the end of the period. We'll have at least one break between now and the end of the hearing. I will call the name a second time and if the person still is not here, then that person will not be called to speak again.

Lastly, I ask the entire audience to be courteous and not to talk while a recognized speaker is still speaking. I recognize that some people may be in

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agreement or disagreement with what is being said, but I ask that you all be courteous to the speakers.

Okay. Having said that, let me go through and do my shuffle. And the reason I do this is to give everybody an opportunity and each person, regardless of who they are, the opportunity to be speaking first.

And the first person I have is Peter Zavattaro. And, sir, if you would come up, and while you come up I will draw another name here, and that is Ila M. Clemente, and if you would come down here in front while Mr. Zavattaro is speaking. Mr. Zavattaro.

MR. ZAVATTARO: Good evening. My name is Peter Zavattaro. I am a resident of Las Vegas, a long term resident of Las Vegas. And I am interested in the -- deeply interested in the future of the area.

I'm the general manager of EG&G Energy Measurements, a company that has been in Las Vegas and worked at the Test Site for over 40 years. I am the chairman of the NTS Contractors Association, an organization which represents more than 8,000 employees of Southern Nevada.

I'd like to address the Air Force's Draft Environmental Impact Statement for the Space Nuclear Thermal Propulsion program.

Since 1951 the Nevada Test Site has been the

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testing ground for this nation's nuclear research and development program.

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There are many reasons why locating the Nuclear Thermal Propulsion program here would be most advantageous to the Air Force.

The Test Site, which is located 100 miles from any major metropolitan area, provides a safe, secure and isolated environment for the nuclear testing project. Its proximity to the Air Force's Tonopah Test Range and Nellis Air Force Base allows for convenient air and ground transportation to the site project.

Further, the test site infrastructure of roads, buildings and housing is already in place and would simplify and make the project cost effective.

Additionally, there is a comprehensive off-site radiological and meteorological monitoring network in place. This project offers a unique opportunity for Nevadans to be on the cutting edge of the nuclear propulsion program.

And there are few, if any, communities in the United States where you can find the scientific and engineering expertise in all the aspects of nuclear research as you can find here in Las Vegas.

I also appreciate the fact the project poses no threat to the Southern Nevada environment and the people who live here.

The Air Force has always been, and always will

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be a welcome neighbor and as well as an integral part of our community. In addition, the Space Nuclear Thermal Propulsion project to the Test Site would enhance that relationship. Thank you.

(Applause)

COL. HUEPEL: Thank you.

What I am going to ask, I am going to ask you not to applaud for whichever side you are on, because that's going to take more time, too, and I want to get through everybody's presentation.

Let me also say, we've got to keep the doors closed, because I think some of you were for a period, and I apologize, Mr. Zavattaro, that the noise from outside -- I ask the smokers, if you need to smoke, if you just step outside and have your smoke and then come on in, that would make it a lot better, since we do need to keep it closed.

Now, Ms. Clements. And after her will be Drew Spangler. Yes, ma'am.

MS. CLEMENTS: Okay, I have a big problem with some of the wording for the safety standards you propose to follow in your testing of the PBR project, specifically,

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when you say it will be as safe as reasonably achievable. Whatever happened to the absolute minimal allowable standard of safety for a program that's no go?

So far, in the area of nuclear activity, the

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1 cont'd reasonably achievable standards have been environmentally
unsafe and polluting. The reasonably achievable standard
12.1 has left our country piled high with toxic and high level
waste, for which we have yet to find a safe and viable
disposal or a containment thereof. I don't like this
wording at all.

COL. HUEPEL: Thank you ma'am. Now, is Mr. Spangler here? Drew Spangler? And while Mr. Spangler is coming up, I didn't see you come up. I'm sorry about that.

MR. SPANGLER: Yes. My name is Drew Spangler. I am representing Citizens Alert from Las Vegas, Nevada. I have been a resident of Las Vegas, Nevada now for 15 years, and I have seen things up in Nevada Test Site which I really don't want to comment at this point.

This is, my comments are about if there was an accident up at the Test Site, you know, of course, with the previous question about health and safety. And two, I'd like to find out what's, why is the space rocket being shoved down Nevada's throat like the rest of the Yucca Mountain as well as the Test Site?

And three, I know I am getting a lot of animosity right here, because I am wearing a Frontier striker's shirt, but the thing is, that I'd like to know, what good is it going to be for the City of Las Vegas as well as the State of Nevada to put this project here? I

understand that there is going to be a lot of jobs, and of course, you know, with jobs and stuff, you know, of course, it comes, you know, to good economics. But what do we have to pay for these economics?

You know, human suffering, as well as other things, you know, and as a concerned citizen of Southern Nevada, I don't like to see, of course, my kids getting hurt with the possible nuclear, you know, situation, transportation, and you know, different things, when I do have some kids.

And I'm concerned, of course, about the families of Southern Nevada as well as central Nevada, too, about the safeties and hazards of having these space rockets put into this particular state. Thank you for letting me share it.

COL. HUEPEL: Thank you. At this time would be David Geertz, to be followed by Donald McDermott.

MR. GEERTZ: Hi. I've got a two-part question, please. First historical, second mathematical. I'd like to address my first question, please, to Lt. Col. Gary Baumgartel.

THE REPORTER: Could you state your name, please.

MR. GEERTZ: My name is David Geertz. I'm from Las Vegas.

And my first question would be, what went wrong

with the project NERVA? Funds? Or does that continue?

COL. HUEPEL: Well, I'm not going to allow that question, because that's not involved with this program.

MR. GEERTZ: Okay, here we go. That's 0 for 1, folks.

And question number two, I would like to address to proponent Lt. Gary Bleeker. How many gallons of strawberry ice cream were necessary to coerce Baskins Robbins 31 to give up their nuclear technology?

COL. HUEPEL: Similarly, you know, that's not really a clarifying question.

MR. GEERTZ: That's 0 for 2.

Thank you very much.

COL. HUEPEL: Thank you.

MR. GEERTZ: Keep up a lot.

COL. HUEPEL: Okay.

After -- Mr. McDermott is next and followed by Donald Baltz.

MR. McDERMOTT: My name is Donald McDermott. I'm a resident here of Las Vegas. And I don't represent any particular group. I am a member IBEW Union. I have worked at the Test Site before for REECO, and I'm very impressed with the safety and everything we have there.

What I would like to read to you is this: It is my understanding that Nuclear Thermal Propulsion has already

been tested and proven to be one of the most successful programs ever undertaken.

Also, that it is an absolute minimum amount of radioactive material used, and next to none in leakage in the radioactive activity.

The production of heat is a chief product of this nuclear reaction. It is one of the safest uses of radiation. This propulsion system has considerable advantages over conventional propulsion systems and clearly
8 marks a jump in technology. The advantages are numerous,
and present a new industry for our nation and its people,
13.2 and I, for one, would like to see Nevada keep nuclear
propulsion and nuclear testing right here. Thank you.

COL. HUEPEL: Thank you. After Mr. Baltz will be Frank Clements.

MR. BALTZ: My name is Donald Baltz. I live here. I am representing myself. I have lived in Las Vegas for 29 years. My children were born here and educated here and I continue to live here. My parents moved here after their retirement.

I might say I'm a very permanent resident of Las Vegas. I have a very strong interest in the health of my family and of my neighbors. Educationally I understand the technology that's involved here. I have a college degree in physics and I have worked in the industry for a

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lot of years.

I state this only to give you my background and establish a bit of credibility as to where I'm coming from.

With regard to risk to the loss of -- or risk or danger of the kinds of tests you are talking about here, after evaluating the presentations, I find that I faced more risk driving my vehicle to this meeting than what there will be to, either to the environment or to the general population.

The risk to the environment, as I see it, is less than the pollution caused by me driving a car and less than the danger exposed by the people who left this room to smoke a cigarette. I find nothing wrong with this project. Thank you.

COL. HUEPEL: Thank you, sir. After Mr. Clements will be C. E. Foster.

MR. CLEMENTS: Thank you very much for this opportunity. I had made a cursory review of your Draft

2 2.1 EIS. I think it would be helpful in the final if you would explain the purpose of it. The present draft only says potential application.

3 2.2 Also, I think it would be helpful to clarify in the final that this rocket, this engine, according to the Draft EIS, is an upper stage rocket because initial experiments using it as the primary thrust mechanism, as we

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3 2.2 all know from history, has failed and did create quite a bit of contamination.

Then, too, in looking through the Draft EIS, I found no breakdown of the elements normal to nuclear reactors. In effect, what you are doing is putting a small, mininuclear reactor into space. And if I understand it right, we would then be producing over 80 elements that are common to the operation of the nuclear reactor. For example, plutonium, which would be a natural by-product of the fission process would have a half life of 24,300 years.

So the document, I didn't find how much is produced in the terms of ounces or pounds or whatnot in this very small reactor.

Like cesium, we know from the atmospheric tests at the Nevada Test Site has fallen all through New England, parts of New York and Pennsylvania and is now in the chain through the harvest of the trees, both toothpicks and pulp wood. And since people there are using wood fireplaces and so forth, put the ashes in their garden, it's now in their food chain.

4 2.2 So when we put a nuclear power plant into space, I think what is needed is a risk assessment, because the biggest threat seems to be, on the surface, would be an orbital decay.

And those things are just not addressed in

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4 cont'd 2.2 there. And I think they are going to have to be, because the country is broke financially, so they should be spending their money on the most priority items. And a better explanation might put it, find out what the priority is. Thank you very much.

COL. HUEPEL: Thank you, sir.

Go ahead, Col. Baumgartel.

LT. COL. BAUMGARTEL: I just want to clarify a couple of things for the speaker. I think we have the answers for them.

The by-products are listed in the tables in Appendix E, all the by-products from the different tests. Also, it says potential application, because there are no programmed applications for use in space at this time with respect to the, definitely second stage, no first stage application that you can even dream about. That's in the document. This is just a ground test of the technology. It's not assembly essentially of the flying rocket. Those are in there.

So if you look at the document again, if you still have questions you want to address, we will take your questions and make sure that what I'm telling you is correct. But we are pretty confident that those answers are in there and you can look at them. Okay.

COL. HUEPEL: After Mr. Foster will be David

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Solnit, Mr. Foster.

CHESTER FOSTER: My name is Chester Foster. I'm a resident of Clark County. I just want to say that I agree with our first speaker 100 percent. Thank you.

COL. HUEPEL: Thank you, sir. After Mr. Solnit, who is coming up right now, will be Shaun Stenshol.

MR. SOLNIT: My name is David Solnit. I am a resident of Las Vegas. I work here as a carpenter and I'm also here representing American Peace Test.

I just wanted to make some historical notes about the nuclear rocket, which is, from my research it was a program that was tested quite at bit in the 1960s and '70s in a program that was cancelled in the early 1970s, in part due to public safety concerns.

And apparently it was revitalized by the, by our government, and was kept secret until the American Federation of Scientists exposed the secret development, which was confirmed by documents obtained by the New York Times.

And another note is, I am real concerned about the process. What seems to be a concern for a democratic process here, I think is often a decision that we actually have no say-so in. In fact, my understanding is the government was going ahead with this program until the threat by environmental groups to file a law suit to force

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these public hearings, that these are not voluntary public hearings done in good faith.

And also, to mention that during the last public hearings there was only one week notice, which made it real hard for a lot of folks to get out.

The purpose of these nuclear rockets, it's my understanding, is to power massive lasers, powerful beams, homing rockets that are part of the Star Wars program. The high thrust and low fuel weight make this rocket vital to the success of the Star Wars program.

And my understanding of the Star Wars program is that its purpose, in conjunction with the nuclear weapons program, is to further the United States' ability to threaten the further use of nuclear weapons and to defend itself from possible retaliation after use of a first strike. And it seems like this is a very chilling vision of the U.S. mission in the post-cold war, a vision that a secret Pentagon policy document in March described as a mission to secure and enhance the U.S. position as the only global military superpower relying in part on the threat of first use of nuclear weapons.

And I think if we want to, and I think we need to, move towards a world of security and of, we need to move towards disarmament and not towards unilateral escalation of the arms race, undermining of the non-proliferation treaties

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and regimes.

So I think the purpose of this entire program is something which is not in interest to the people of Nevada or the people of the United States.

5 12.2 I also wanted to notice, as I said before, that this nuclear rocket was tested in the past and my understanding is the rocket is much hotter than a normal reactor, and because of it's lack of containment vessel, operates in excess of 3,000 degrees, which is right on the limit of what the metal it's made of can tolerate, it creates a greater possibility of a melt down and in the past, what happened in 1965 during a nuclear rocket test which sent radioactive iodine from Nevada to Montana.

C 13.4 And so I would urge, very much urge, that you not bring this project to Nevada or anywhere, and very much urge that the resources spent on this be put into the civilian sector where they would, according to studies, create a greater number of jobs, which are deperately needed by the people in Nevada. Thank you very much.

COL. SUEPEL: Thank you.

Is Sean Stenshol here? Okay.

Then next would be Claud Smith, to be followed by Roger Wolfley.

Mr. Smith?

MR. SMITH: My name is Claud Smith. I work for

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a company called EG&G. I am a resident of Las Vegas for about 30 years.

13.2 D I think we need this program here. And I would say because in the late fifties and throughout the sixties, and even into the seventies, we had -- the nuclear rocket development facility was here, and we did a good job for the government, and the technology that we pioneered for space development was almost unparalleled.

So saying that, I think that we have the expertise here and I think we need to be considered for it, very sincerely. Thank you very much.

COL. SUEPEL: Thank you. After Mr. Wolfley will be Charles Hilfenhaus. Mr. Wolfley.

MR. WOLFLEY: My name is Roger Wolfley. I'm a resident of Las Vegas, Nevada. I worked for REECO at the Test Site as an iron worker and also worked in the safety department out there.

We have the best labor anywhere. We have the people to do the job safely, and in compliance with EHAS. I have had the pleasure of also working on both test sites. I
13.2 E worked on the Test Site in Nevada and also the one in Idaho. I prefer this to go here in Nevada. Thank you.

COL. SUEPEL: Thank you, sir. Is Charles Hilfenhaus here? Okay, not here. Steven Cowart. Is Steven Cowart here? Okay, to be followed by Jack Jeffrey.

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Mr. Cowart.

MR. COWART: Yeah, my name is Steve Cowart. I'm from Las Vegas. I am an iron worker. You know, in your demonstration here we talked of the cost and the safety. It seems like the cost is going to be less in Idaho, but the
F 13.2 safety is going to be greater here in Nevada. I think that should be given the biggest amount of consideration in using the Nevada Test Site. Thank you.

COL. SUEPEL: Thank you. After Mr. Jeffrey will be Jeffrey Gordon. Mr. Jeffrey.

MR. JEFFREY: I'm Jack Jeffrey. I'm representing the twenty affiliated unions with the Southern Nevada Building and Construction Trades Council. I have also been a resident of Southern Nevada for over 50 years.

G 13.2 The Building Trades Council has taken the position in favor of this project, primarily because we are concerned about what happens at the Test Site and what may happen if the moratorium does come about on atomic testing.

We are working at the present time with the Contractors' Association, the Nevada Test Site Contractors' Association, and Senator Reid to find alternate uses at the Nevada Test Site. We think that this is a fitting alternative to the atomic testing, should a moratorium come about.

COL. SUEPEL: Thank you, sir. Mr. Gordon is

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coming up, and after Mr. Gordon will be Douglas Patten.

MR. GORDON: Good evening, Colonel, gentlemen. I'm Jeffrey Gordon. I'm here representing my wife and my daughter, Katherine, over there. I've been a citizen of Las Vegas for about 30 years now.

I do have one question, sort of a brief confirmation before I make a quick statement. When the hydrogen propellant is heated and released from the rocket, how much radiation is released? I have heard minimal, but do you have an answer to that?

LT. COL. BAUMGARTEL: Can you define test facility?

LT. COL. BLEEKER: Where would this be?

MR. GORDON: In the test facility here in Nevada.

LT. COL. BLEEKER: Assuming those particles work as expected, none, actually. The cases that were done, we're taking the worst cases, it said nothing essentially worked. We are talking about a couple grams of fissionable-type material that has to be cleaned up by that, quote, exhaust system.

MR. GORDON: See, personally I don't mind that 13.2 at all. And I'd like to see that sort of thing in the tests going on here in Nevada. I'd like to point out my wife Linda and my daughter Katherine. She's sleeping over

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in a chair there. Little Katie has asthma. And she is alive and full of happiness and love today because of the technology that's been developed through the space program.

I know this is about an environmental impact statement and environmental risk that you are looking at in your testing. But I thought that that was an important thing as well, that the space program and its developments have benefitted far more people throughout the United States than it has endangered.

There is also a sign over there that says, there ain't no 100 percent safety. Well, that sign is probably more true in Florida and Louisiana when Mother Nature cuts loose with a hurricane than it seems to be here in Nevada from testing that you all plan to do.

I am damn proud to see that the Nevada Test Site poses less risk to the public and to the environment than does the proposed test site in Idaho.

We live in a state that prides itself on gambles and risks when it comes to people's money and our own. But we don't take risks with our environment. The Space Thermal Propulsion program is far more of a sure thing than anything else we do in this state.

I'd be very proud to see a rocket or a space shuttle launched that's been developed in our state, in

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Nevada. I think it's far more of a sure thing that we'll all benefit immensely from the program and the test and the new life here than the environmental risks that are associated with this program. Thank you.

COL. HUEPEL: Thank you.

After Mr. Patten will be Michael Bowdeaux. I may be pronouncing that incorrectly. Mr. Patten.

DOUGLAS PATTEN: My name is Douglas Patten. I'd like to welcome you to Southern Nevada. I have been a resident here since 1957, approximately, and I'd like you to 13.2 know that I am completely in support of this project. I hope you bring it to Southern Nevada.

The gentleman that just spoke before me probably said about what I was intending to say. I'd like to expound upon that a little bit. He was saying that the sign said things are not 100 percent safe. He's certainly true about that. But neither are the brakes on some of the cars that some of these people are going to drive home tonight. They may not work.

But that doesn't stop them from driving the cars. There's always a risk in anything anybody does. You have to balance it out with what are the gains, what are the trade-offs for?

I'd like to talk about spinoffs, like when this project is a space-type project. Just about everything we

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have, the cameras that they are filming this thing with, are a result of technology developed in that program. EKGs, MRIs, CAT scans, all the stuff to keep people alive, save millions, maybe billions of lives over the years are spinoffs from this type of stuff.

And I think it's something people should consider before they start saying, well, if a couple of birds are going to die, or something like this, we can't do the program. I hope you will go ahead with it. And thank you very much.

COL. HUEPEL: Thank you. Now, as I said, I may have my butchered the name, but Michael Bowdeaux. Are you here? Doesn't appear so. Okay, how about Louis Benezet? After Mr. Benezet will be Scott Galindez.

MR. BENEZET: I thank you for letting me speak here tonight. My name is Louis Benezet from Lincoln County, Nevada. I'm speaking here today on my own behalf.

I have a certain natural skepticism of Air Force projects, having fought the MX in Lincoln County. That was one for one. Later we saw the Groom Mountain taken, legally at first, then ratified through a process as quiet and peaceful as this one tonight.

I hope one day that I will live to see the Groom 9.1 Mountain restored to public use. I hope one day I'll live to see the Test Site restored to the Shoshone people, whose

6 cont'd 9.1

land it is, so that we can gather, go and come.

I don't think that another nuclear project in the Test Site is a step in this direction. So I asked myself, why is it justified? I understand the Timberwind project was conceived in secrecy. It was part of the secret project of our military installation. The same kind of secrecy that justified the Groom Mountain take-over.

7 2.1

Now that you are out in the light of day, we can look at it and see that it's not justified. There is no need for a nuclear rocket at a time when the eight hundred million dollars that you might spend just starting up this program could be spent to relieve the plight of our homeless people, to cure AIDS, to clean up the environment, including the Test Site, the Nellis Range, to find alternative sources of energy that are safe. Solar power would be an excellent choice of use for that land.

So I would just end by saying that I think that your EIS grossly misstates the impacts of all the alternatives, including the no action alternative.

J 13.4

The major impacts of your alternatives are the diversion of funds from services that could benefit people. The major impacts of the no alternative, no action alternative, is the peace dividend which could greatly benefit all of us. Thank you.

COL. HUEPEL: Thank you.

Mr. Galindez here?

Apparently not. Mr. Frank Laine. And after Mr Laine will be Augie Gurolla.

MR. CAINE: Is that name Caine or Laine?

COL. HUEPEL: I'm sorry. Caine. It is a C.

MR. CAINE: Yeah.

COL. HUEPEL: I said it right the first time.

MR. CAINE: Couldn't figure out my hieroglyphics there.

I am Frank Caine. The president of the Southern Nevada Building Trades Council, and I'm a resident of Las Vegas for thirty-some years. I'm also a four-year veteran of the United States Navy, and 30 years work in this town as an iron worker in construction.

I worked at the Test Site, and by far it has the best safety program in the world. I worked there and saw it working, and see that it's implemented daily. Of the construction workers that I've worked up there, and have known for the years, one of my stewards has been up there 30 years, he is well and healthy.

As far as the 100 percent thing, the safety, medical profession is not 100 percent safe, but they keep trying to fight cancer and AIDS and everything else. And I am certainly for that.

I didn't come here as a rocket scientist. I

don't have all the figures. My people didn't send me here in that capacity.

K 13.3

But I knew that if the United States Air Force thinks they need this to make our country the best country, which it is the best country in the world, but the strongest country, in peace or war, I certainly concur with their needs and wants to go on with this rocket project. Thank you.

COL. HUEPEL: Thank you. After Mr. Gurolla, and I apologize if I am mispronouncing that, would be Phil Outlaw.

MR. GUROLLA: You did a better job than I did.

My name is Augie Gurolla. I think that's the way you pronounce it. And I am president of the Latin Chamber of Commerce, and I am also affiliated with Lockheed Corporation.

L 13.2

I am here tonight because I support this program and I endorse it fully. I believe this program is good for our country, it's good for Nevada and it's good for Las Vegas.

I have been associated with the Test Site for some 37 years off and on. Some by choice, some otherwise. I was part of the above-ground testing, and I also participated in the underground testing.

In fact, I designed some of the early

above-ground shot towers that were used to test some of our nuclear weapons.

I have crossed the Nevada Test Site from one side to the other. I know practically every square foot. I have participated in, or I am aware of most of the operations and activities that took place in the Test Site, and these activities are consistent and compatible with the activities of this program.

And I can say with utmost veracity, that never, never, never, was anything done that was intentionally unsafe or that it would harm the environment.

Some would say, of course, you did shake a few buildings in Las Vegas. I'm very proud of the many years of my association with the Test Site. And now I want to say that we find ourselves with two Herculean issues. One is the proliferation of gaming, that is, foreign gaming outside of the State of Nevada, and I perceive this as a detriment to Nevada.

And secondly, we are slowly approaching zero testing at the Nevada Test Site. These are two serious issues that will have a grave consequence on the economy of Nevada.

Now, we have an opportunity to embrace a program that is safe and that will help maintain our work force and stimulate the economy, and perhaps be a catalyst to

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additional work.

Others will take note that Nevada knows the word yes. And to all those other folks that think otherwise, my comment is, if we continue to say no, no one is going to ask us to dance. Thank you.

COL. HUEPEL: Thank you. After Mr. Outlaw will be, Eugene Throckmorton. Mr. Outlaw.

Eugenie, I'm sorry.

MR. OUTLAW: My name is Phil Outlaw. I speak as an individual. I'm new to this area, but I have a master's degree in physics, and I do have some opinions in this area.

Years ago, in the sixties, I saw the space program was halted because people said, we could feed the poor and we could house the poor. So we laid off thousands of people and put them out of jobs.

I saw the SST project closed down. We said we could save some money. It turned out that the SST project would have saved more money completing the project and finding out what we could and perhaps share in some of the benefits that the British are doing from their STT in the process.

Our space program, even after laying off all the people, losing all the jobs, we found out that spinoffs from the space program more than paid for it. Some of the people

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mentioned some of those spinoffs in the medical area tonight.

I think environmental groups are good. We have caused some areas, Department of Defense and Department of Energy, to put more stringent controls in some areas that needed it, and we have made mistakes in those areas. We dumped nuclear waste in the ocean. We shouldn't have. And some of these environmental groups have helped.

And it's okay to ask for stricter controls, it's okay to ask that we be wiser about controlling our environment. But let's not give up our dreams and give up the technology we can gain, because of ignorance, because we don't understand what's going on.

We mention we can't be 100 percent safe. And the main concern I have is just ignorantly disposing of properties, totally, because we see a few bad things, because we could improve our standards.

All I ask the environmental groups, let's approach this intelligently and ask for the right things, not try to cost us jobs and cost our dreams of having better technology so our grandchildren can see a better world because they don't understand what's going on. Thank you.

COL. HUEPEL: Thank you.

MS. THROCKMORTON: I am Eugenie Throckmorton. I have lived here since 1955. A woman was at the beginning of

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the hearing application of things nuclear. Her name was Marie Curie.

When I was a teenager I was very impressed with the book written by her daughter, talking about a mother's life, describing how she extracted the first uranium from the pitchblende which she dug up in Bohemia, very painstakingly taking it to her laboratory in Paris.

It was many years later that I discovered, and I am not sure that her daughter covered this, maybe I overlooked the fact, the detail, but many years later I discovered that her husband had cautioned Marie, Pierre Curie, had cautioned Marie that laboratory research was showing that leukemia could be developed from exposure to the radiation.

She chose to disregard that information and continue. She eventually died of leukemia.

I suggest that she began the nihil that has run parallel to the entire history of things we fear.

Pierre was so preoccupied with her tunnel vision, we'd say today, her technological intent focus rather than an overall scientific view, anyway, he was so preoccupied with her, the fact that she would not look at these findings, that given is one cause of his walking in front of a horse cart killed him.

I was born in Nebraska, but moved to Albuquerque

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in 1937. And I married a boy, a man, who was a paper boy at the time of the first explosion in Alamogordo. He happened to be facing south that day. He was wrapping his papers early in the morning that day and saw the entire sky light up, and watched for the news the next day, and nothing was there. And he went to the people who write about such things, and they didn't know about it.

It wasn't until some days later that the world was told about the event.

That was the beginning of what we call news, the terminology isn't right, the controlled news about things we would hear.

In high school a young boy gave me some molten green glass that he and his father had picked up out on the Alamogordo site. The white sands were molten by the heat of the explosion. And I carried that in my wallet for several years. And that was because of the radio activity. There's a lot of ignorance about it. There is a lot of lack of responsibility in the handling of it.

When I moved to Nevada in 1955, the scientists, they term themselves scientists at the Test Site, they had cattle there, they drilled holes in their abdomen and put glass portholes in there. I guess they take samples and things. All that is very interesting. Rather inhumane. I think possibly the Humane Society squawked enough to get

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them to -- so we haven't heard about it for several years.

I have clipped many newspaper clippings since 1988 about oversights, things like screws not matching bolts, and things being dropped accidentally into the bottom of the pit. That's probably the least of the talks of things that happen there.

I read about the Utahans being poisoned by radioactivity, and the information was hidden from us. We were ignored when they tried to get information and when they complained. We commit genocide on the Indians. Not only in Nevada, but also in --

Is it five minutes already?

COL. HUEPEL: Yes, ma'am.

MS. THROCKMORTON: So I just want -- about jobs -- let me finish this about jobs -- many people are concerned about jobs. If you continue on a nuclear route, that is the Old Wild West, it's out-dated already.

Let me suggest that you do a research in mental technology. That's just around the corner. I hope we have a long discussion on the ethics of it before we get to rolling on it like we did on this. Again, look up the word, mental technology, anybody here, and get your foot in that door first. Thank you very much.

COL. HUEPEL: Thank you ma'am. Next will be John Stangle to be followed by Charles Phillips.

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MR. STANGLE: Yes, my name is John Stangle, and I'm next?

COL. HUEPEL: Yes, sir.

MR. STANGLE: Okay, I guess I was waiting for somebody else here.

COL. HUEPEL: I hadn't called any name earlier I hadn't gotten to it, so you've got it.

MR. STANGLE: I have a couple of questions. I guess, and then also maybe some statements. But I want to say that I was quite enthralled by the presentation. I have sort of a basic, that kind of a basic love of science. I guess, and of imagination and thinking up projects and doing things, and there's something that sort of appeals to me about things. And I feel hopeful about the possibility of spinoff, and there has been a lot of spinoff from different projects, that's true, although in this particular case I'm not sure that the goal is there why we ought to do this.

It's been alluded to that it was a project more pertinent when we had this evil empire that we maybe needed to fight, and without that, you know, I agree with the speaker who said, or the speakers who said, that there are more maybe basic needs that we have in this country.

I don't know, maybe the money is already there for the Air Force to spend, in which case I guess you have a decision to make, you know, whether to go ahead with

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something that possibly may never be used, even though it's interesting and provides jobs.

8 Although, I was quite surprised that the jobs were so few. In fact, I find that not quite believable that it's going to take 30 people on the Test Site to construct this -- you are talking in my mind, I'm hearing this immense building of these facilities, and at one point, the most I
3.5 ever saw listed was 120 jobs, and at one point -- I'm not talking about running this project once it's made, but in the construction of it, you know, it just doesn't figure me, really, that you could do it. That was the most surprising thing to me about this whole thing, is that there was only like 30 to 60 jobs, maybe 120 at the most.

The questions I have are, since this was tested in the past, or at least certain aspects of it were tested in the past, there probably was some sort of environmental look at what was going to happen and what did happen. And these would have been classified.

I am assuming that this thing isn't totally new, that nothing has been tested and it's just kind of in somebody's head that let's maybe little particles, and let's put graphite or ceramic about them and see what happens if we run hydrogen through them. So I'm assuming that somebody has made particles and run hydrogen through some -- on some scale somewhere -- and classified, you know, effects that

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happened.

And I'm wondering if these classified effects or when the project was classified just recently and you did an environmental impact statement of some sort, which also would be classified, if that could be released for the public to look at, and this way for scientists on the outside to be able to measure, you know, what you say did happen and see if there's anything that maybe was missed or to see if it's reasonable.

So I assume there was some kind environmental impact statement made by the deceiver. I mean, you wouldn't just do this without kind of looking at the effects. Right?

LT. COL. BAUMGARTEL: I can answer that question. The answer is yes, it's declassified, it's available. I need to ask one of my books I'm looking for. I don't know if it's at the libraries that we listed. Scott, do you know if it's got the libraries? I know the DOE office here in town has a copy in their library in their office. Is it?

CAPT. HARTFORD: It's in the Clark County library.

MR. STANGLE: He said Clark County library.

LT. COL. BAUMGARTEL: Clark County library.

MR. STANGLE: Uh-huh. Now, this was the -- one of the secrets is the Environmental Impact when it was a

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secret project.

LT. COL. BAUMGARTEL: Right. That is correct.

LT. COL. BLEEKER: In addition, testing has occurred at other facilities. You say particles and such?

MR. STANGLE: Yeah.

LT. COL. BLEEKER: Have occurred at Brookhaven National Wildlife and Sedelia National Wild Life, covered under existing environmental impact statements in the listed places.

Some of the results are classified. However, we did our best to publish in our numbers we are proposing to the AIAA there's a space propulsion series about four months away and we are going to try to release all the results we possibly can on that series.

So there's been a fair amount of testing. We know these particles work. We know we can heat them. We know we can put hydrogen around them. So there's a lot behind it.

MR. STANGLE: I think it would be very good if that information could be released and also, you know, I think it would be helpful for people to analyze the whole thing if that would be released.

COL. BLEEKER: Yes, sir.

MR. STANGLE: There's another concern I have. I guess I would call it an environmental impact that we have.

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It's different than an economic impact. I guess I would call it the psychological kind of impact, or maybe even a theological kind of impact. It has to do with us, each of us, as people and our morality about who we are or our thoughts about who we are.

And I broadly classify things into kind of life-giving projects, life-giving things and things that are not considered so life-giving. And it has been brought up. A couple of people brought that up when they talked about steno or when they talked about, they call that a dirty life-giving and they talk about the environmental impact.

So it has been brought up, and I think there ought to be a requirement to look at things from these directions, as to whether they're positive or not. Thank you.

COL. HUEPEL: Thank you. Mr. Charles Phillips. After Mr. Phillips we are going to take a short break and give everybody a stretch, and we'll come back in and finish with the remaining speakers.

MR. PHILLIPS: Yes, my name is Charles Phillips. I have been a resident in Las Vegas and Southern Nevada from July of 1969.

And we have heard from some very eloquent speakers about the spinoffs from space research, profiteering and so on. But one thing I'd like to cover is

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the sense of pride America had when the lunar lander Eagle landed on the moon. I was a young boy when my dad and I, who was an engineer, was watching television and we saw the lunar lander Eagle landing on the moon. I remember the sense of pride that we enjoyed with each other. Well, through him and his explanations I appreciated the technological achievements that NASA achieved through this research development and so on.

M And I would really feel honored to see Southern
13.2 Nevada participate in the next majestic technological space exploration achievement that's going to be developed at the Test Site if they develop this nuclear propulsion engine. And I would, I would cherish the same moment with me and my son watching the same thing as my dad and I did when I was a young boy, if this ever progresses that far.

Thank you.

COL. HUEPEL: Thank you.

We'll take a break. When we come back from the 10-minute break, I'm going to try to keep it right at ten so we can press on.

Chris Brown will be the first speaker, followed by Howard Dickson. Thank you.

(Whereupon, a recess was had).

COL. HUEPEL: Mr. Brown, if you'd go ahead, Mr. Chris Brown will be first and Mr. Howard Dickson will be

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following.

Ladies and gentlemen, if you would please be quiet?

MR. BROWN: Hi. My name is Chris Brown. I'm the Southern Nevada Director of Citizen Alert, a state-wide
9 environmental watchdog organization. The lack of a mission
2.1 statement in this document is sufficient to say no purpose or need is demonstrated under the CPQ or the National Environmental Policy Act.

The need for requirement for demonstrating need and purpose is not fulfilled by saying we think we can do this technology so why don't you let us build something and demonstrate it? In fact, what you are asking us to approve is a giant Erector set for nuclear physicists and the American public just doesn't need one of those.

It's kind of like the nuclear-powered airplane that was proposed back in the fifties. They actually built one. They ran some tests, they made a big mess out of that. We found out we didn't need a nuclear-powered airplane, either.

10 About the process. Public input is not successfully taken in an accelerated process that you are
1.6 attempting with this EIS. You should slow it down. The document suffers from this.

You have spent a couple of years in classified

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10 cont'd 1.8 status. You have modified this. The public has not had time to read it. It's only been out publicly for a couple of weeks and you are only giving a few more weeks for people to get in written comments. The comment period should be extended to the end of the year.

11 1.7 There is no appendix with the public comments from the scoping period. *I know for a fact that the* comments made by Citizens Alert, which is a state-wide organization, were not addressed in this Draft EIS, and I'm pretty sure that other comments made by other people were not addressed.

The only way that the public can tell that their comments are being dealt with seriously is if you include an appendix with their comments and the responses that you make to those comments.

12 12.3 Your safety analysis is insufficient. The DEIS basically asks the public to accept on faith what you say the safety will be, without showing a clear structure of the safety systems that will be put in place. There are some assumptions in here. The fact that there will only be a thousand seconds worth of radionuclides. *If* in fact you have an out of *control accident, there is* not way to stop it at a thousand seconds. That's the whole nature of it being out of control.

The reaction will go on, indeterminably greater.

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depending on how long the reaction goes on.

Citing the DOE regs as some assurance of nuclear safety is no way to reassure the public. There are 40 years of history at this site and many others that show the public you can't trust the DOE when it comes to *nuclear safety*.

13 12.4 *There's* insufficient detail on control and containment. There's suggestions that you can control criticality in the document, but there's no diagrams showing us how that technology of control will be maintained with these small sand-like particles of uranium-235.

14 6.1 There's insufficient detail with regard to the handling of nuclear waste. In fact, *there is no real* discussion *of the handling of high* level waste, which these cores would be. The reactor core itself would be high level waste.

N 13.4 The preferred alternative in this case is clearly the no-action alternative, since there is no mission in the document, then no action is what is called for. This would be the safest and best decision. It would cost us *the least and benefit us the most*. And that is very clear *from* what we have.

15 9.1 But as I feel that you are going to probably pursue this DEIS, since it is faulty, it doesn't deal with an earlier treaty of Ruby Valley, Shoshone Land Rights, for example. It needs major work, if you are to continue

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and produce a *final* EIS. You basically have to go back to the drawing board and put in a lot more documentation on all the issues I have brought up, and some that I haven't tonight.

16 1.16 You might even learn to write it in English. For example, using the term bounding energetic accident to describe a hydrogen explosion is not *very acceptable as a public document* that's supposed to tell the public what the potential accidents are. Call it a hydrogen explosion, since that's what it is you are talking about.

17 1.1 Another issue that's really at stake here is that a programmatic EIS is being done on the Nevada Test Site and all the other DOE facilities, including INEL, on both the cleanup and the reconfiguration of *those sites*. *This EIS should be subsequent* to those PEIS's, since a programmatic EIS takes in all of those sites in the entire -- encompasses all the general issues.

Specifically, this program will generate high level, low level and true wastes, all of which are covered in the PEIS under cleanup. This project is not currently being pursued as any of the theory weapons *complex* and it's proposed *as a new project*. *Therefore*, it comes under the *reconfiguration* PEIS.

Legally, I think we have a very hard case to make that you should be allowed to go forward with this

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17 1.1 until the PEIS is finished. I think it's very clear that this thing should go on the shelf, at the very minimum, until after the PEIS's are completed, and then after that point, and we have the standards and we have the measurements for how much high level, low level and true waste can be accepted at the sites, or what facilities are prepared to take new *programs*, at that *point*, *you* might want to dust this off and bring it back to the public.

But basically, this thing is still a Star Wars project that you panned with a new name. You haven't given the public enough detail. It's essentially a cold war left-over offered to us at prime rib prices, and it's time for you gentlemen to push yourselves back from the table and quit asking the tax-payer to *feed your habits*. Thank you.

COL. HUEPEL: After Mr. Dickson will be Peg Bean.

MR. DICKSON: My name is Howard Dickson. I'm a deputy general manager for REECO. I'm a citizen of Las Vegas. Prior to coming here this evening I didn't really have an intention of addressing the group, but I didn't actually want to pass up this opportunity to express to you how I feel about the project, so I am taking the opportunity now.

I'm not a neophyte to this business. I have

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been involved in work with nuclear reactors and related facilities for over 25 years. My specialty is actually radiation safety. I'm a degreed physicist, nationally certified by several professional, health and safety organizations.

I feel like I know what I am talking about in this area. In fact, I have been a senior reactor operator in the past. And I don't see the risk associated with this project as being something that's unusual and foreign to me.

However, my experience tells me that the biggest risk associated with the program right now is ignorance and fear of the unknown, which has been what we have had to deal with in most other nuclear projects that I have been familiar with and been associated with.

I am confident that we have the technology to overcome the challenges associated with this and be able to conduct it in a safe and environmentally sound manner.

Also, I want you to know that we have a talented work force at the Nevada Test Site. They certainly have the knowledge and eagerness to support you in this endeavor.

And I believe that, again, that there's every indication that we could go forward with the project and support you in a safe and sound manner.

O 13.2 And I really hope that the Air Force chooses the

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O cont'd 13.2 NTS, if and when you decide to go ahead with the validation tests.

COL. HUEPEL: Thank you. Peg Bean will now speak, and after Ms. Bean will be Bill Flangas.

MS. BEAN: Contrary to my -- my name is Peg Bean. I have lived in Las Vegas for about 27 years. I'd like to live here a while longer, you know, but it doesn't look like a real attractive place to stay any more.

Contrary to what the previous speaker said, it isn't fear, ignorance and fear of the unknown that bothers us. It's fear of what we do know. It's our fear of what we see, when we look back at the nuclear history of Nevada and the government operations in this state.

I have a couple of questions based on your presentation.

[illegible] 3.1 One, how many other locations fit the criterion for location of the project that you talked about in the presentation, and if there are any other locations, what were they or where were they and why are they not being considered at this point?

How many potentially devastating nuclear programs will be located in Nevada before the government and the military decide that enough is enough?

We have had above-ground nuclear weapons testing, underground nuclear weapons testing. We still have a threat of a high-level nuclear waste dump hanging over our

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heads, and now here we have another project which will, according to your statistics, bring only 120 jobs into this state? You know, come on. There are three or four times that many people in this room tonight. That's insignificant. It's not worth the risk. It's not worth any risk to the people of this state, and I'm sick of putting, having my life, my children's lives and my friends' lives put at risk for these minimal considerations.

Also, I have heard at this hearing and in many other hearings in the past about these wonderful technological spinoffs. How much more advanced could we be if those weren't the spinoffs, if those were the focuses of our attention, the medical and technological advances, rather than the nuclear and the military were the focus of our attention? I'd like to spend just a few years focusing on those things, rather than accepting them as spinoffs and things we're so lucky to have.

Your presentation was honest enough to make mention of the fact that this project will generate more nuclear waste.

What .ack of ethics and morals allows you to talk about producing more of this nuclear waste when we can't even begin to solve the problems caused by what we have created in the past?

P 13.4 I implore you to reconsider this project. I don't want it in Idaho, either. But let's just

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P cont'd 13.4 not do any more of these things. Let's focus our attention on things that -- as one of the other speakers said -- will give life. Thank you.

COL. HUEPEL: Thank you, Mr. Flangas. After Mr. Flangas, it will be Stuart Waymire.

MR. FLANGAS: My name is William G. Flangas. I reside in North Las Vegas. I'm appearing tonight in my capacity as a native Nevadan in the mining and engineering and previous nuclear testing activities.

I'm a graduate of Mack School of Mines, University of Nevada in Reno, and I'm experienced in operating radioactive environments and very familiar with the related hazards.

My purpose in appearing tonight is to comment on the suitability and the value of conducting this program from the Nevada Test Site. And I list them as follows:

Nevada Test Site at Mercury has successfully served the nation as an outdoor laboratory for weapons testing and a host of other activities dating back to 1951.

During this period a highly skilled cadry of scientific, professional, technical, government and craft personnel has been developed that has no equal anywhere in the nation, and probably anywhere in the world. It is a thoroughly integrated, cohesive and disciplined work force, well schooled in the complicated and often hazardous

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business of building and executing high-tech experiments without losing sight of the safety, environmental, health and quality responsibilities.

Nevada Test Site is located in a sparsely populated area some 65 miles northwest of Las Vegas, within the boundaries of the Nellis Air Force Range. The site is remote. It has a large area for testing purposes. It is already dedicated to nuclear purposes.

It has no population or agricultural encroachment, no major river systems, no fast-moving underground aquifers or public highways running through the area. It is surrounded by mountain ranges and it has a built-in natural security that can be and has been easily maintained.

Its dry climate permits year-round activities with little or no weather delays.

Because of the numerous underground testing and drilling projects conducted at Nevada Test Site over the years, its geological and hydrological suitability has been firmly established, and it remains as one of the most highly-studied and geologically mapped areas that exist anywhere in the world.

The former nuclear rocket development station, NRDS, now a part of the NTS, has available facilities with replacement value that amounts to hundreds of millions of

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dollars, and which could be readily modified to serve new tasks.

This includes such activities as remote handling, sidewall manipulators, sophisticated radiological controls, and so on.

The NTS team has developed a highly sophisticated scientific network to maintain the best possible personnel, safety and health, both for its employees on-site and for the public health and safety off-site. No effort is ever spared to achieve the highest standards possible. The NTS team fully recognizes that business can no longer be conducted in the United States the way it was as recently as a decade ago.

The NTS team has enthusiastically accepted and energetically responded to the new regulatory requirements that affect the environment, safety, health, waste mitigation, total quality and et cetera.

The NTS team is profoundly proud of the major contributions it's made to the nation's security, and its earned self-confidence in their ability to conduct high-tech operations.

Q 13.2 The NTS team is eager to take on and successfully accomplish this new task. I earnestly solicit your consider of Nevada Test Site for this exciting venture that will take us roaring into the 21st century -- probably

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I should be saying blasting off in the 21st century. Thank you.

COL. HUEPEL: Thank you. After Mr. Waymire will be Rob Trenkle. Mr. Waymire.

MR. WAYMIRE: I'm Stuart Waymire. I've been a Las Vegas resident for about 12 years. I'd like to direct the question of risk versus risk perception.

At Yucca Mountain we spent about the last six years studying risk perception. The state spent about 15 million dollars doing so.

R 13.5 Risk and risk perception are not the same thing, and I would just like to suggest that in your analysis of this project that you'd keep those two things separate. A lot of people on the other side of the -- who are not for this project have expressed a number of fears.

One of those fears was that Madame Curie died of leukemia because of radioactive material. I could suggest that Bugsy Siegel died of gambling and therefore we should not have any gambling in this state.

The point being, that there are strings to all these things we should obviously look at: What the effects on the economy are, what the perceived risks there are. But you should not miss the point that risk is a question. Columbus would not have sailed across the ocean if risk perception had been his major driving factor.

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I'd like to conclude with that. Thank you.

COL. HUEPEL: Thank you.

Rob Trenkle is next. Is Mr. Trenkle here? He's left. Okay. Daryll Geertz, and after Daryll Geertz will be Cliff Sanders. Is Mr. Geertz here? Apparently not. How about Cliff Sanders? Okay. Let me -- I'm getting down to, you know, those of you that are left. There are only about three cards. I've got Dr. Leonard Kreisler. Dr. Kreisler, or Kreisler? No? William Middleton. After Mr. Middleton will be Boris Bernstein. Okay? Mr. Middleton.

MR. MIDDLETON: Good evening, gentlemen. I want to compliment all the people here for the ability of the hearing so far. It was pleasant greeting some of my friends in blue back there. I told them they were on a sticky wicket and they ought to have several -- somebody with two or three or four stars out there. This is a hard-sell for this state.

The last time I saw Dr. Keller live on television, his final words were, "Nuclear never hurt anybody." We are now living in the age of George Orwell. Nuclear doesn't hurt. Paul Tibbets was a friend of mine in 1940. I was in sack with a Class 2 clearance as a designated aircraft commander.

The world should get down on its knees that that

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whistle never got blown.

The unfortunate thing about nuclear is, according to Dr. Goffman, who is an associate of Mr. Doc Oppenheimer, and me, and at these experiments, who, after that episode, became a physician and withdrew from physics entirely, said over a quarter of a million people have died in any proper statistical analysis of what nuclear has done to our world.

It's simply unbelievable that this world, apparently this machine will continue to go on. At the end of World War II Winston Churchill said, 'The world will now move to the broad sunlit uplifts, unless the mad scientists do not take us down into a Dantes inferno.'

I'm proud to be associated with Citizen Alert. This paper which I have, they passed out tonight, is a most erudite and scholarly statement. I commend it to those who are truly interested.

Now, I know from the applause that there are a lot of people who are interested in jobs, and I understand that. Yes, I really do. But you have children, too. And a couple weeks ago Congress passed a resolution designating September the 12th as National Children's Cancer Week. The good die young. You have children, too, all of us here, including the people on this panel.

Surely, you are interested in the long-term

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results of what we're doing to our environment. If the short term is a job, even if it's 60, 80, 100 thousand, is it really worth the risk of what we're doing to our environment?

I had my message all taped out here to read to you, because I don't read my notes very well any more. I'm only 75, but I'm thoroughly committed to this problem.

And as I told my friends in blue, you're on a sticky wicket in Nevada. We have quite a long history here in Nevada. I came here after I retired from the Air Force and went into the classroom. I'm interested in children, and our future, and our posterity, not our posterior, as I hear some of our great political leaders now expressing it. It's almost like spelling potato nowadays.

8
13.4
This program will not fly in Nevada, and politically I will work my very hardest to get a referendum from the people of Nevada to stop this program immediately. There's time to do it, because according to your statements, we have 3 to 5 years -- you have 3 to 5 years to shove this turkey down our throats.

And all of the folks who are very concerned about their job at the Test Site have every right to be concerned. There aren't a heck of a lot of jobs that bring in that kind of dough over a lifetime. But if you think it's bad here, look at the nuclear physicists and all their

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folks over there.

One high level nuclear physicist on our television program, and I respect him for speaking the truth, the military industrial complex was taking, not 20 or 30 percent of their GNP like our people, including the CIA, have been saying. Their program has been taking 60 and 70 percent. But they're going to get their nuclear shut down faster than we will in this country. Why? Because they have seen results, and it is totally devastating, what has happened to the environment in that part of the world.

In addition to Congress passing the resolution regarding children, the National Children's Cancer Week --

COL. HUEPEL: Excuse me, sir, I don't mean to cut you off. We are up over six and a half minutes now.

DR. KREISLER: Well, let's go to seven.

COL. HUEPEL: Well, I've already --

DR. KREISLER: Please. That's 30 second more.

COL. HUEPEL: Well, I've already given you a minute and a half over what I gave other people. So I --

DR. KREISLER: The president of the National Association of Pediatricians Weekly recently said in sworn testimony before a committee of Congress, 'If you think all is well with our environment, just walk through the cancer wards of the children's hospitals. Thank you.

COL. HUEPEL: Thank you very much.

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MR. BERNSTEIN: My name is Boris Bernstein and I live in Boulder City, Nevada. I am a retired professional engineer with over 25 years experience in the nuclear business. From '62 to '67 I was manager of facility operations of engine test ban No. 1 at NRDS with the XE nuclear rocket, so I believe I'm speaking with a certain degree of authority what I have to say.

19
6.1
The major shortfall of this report is the lack of discussion of disposal of the reactor cores upon completion of testing. This concludes from the test, that ten 500 megawatt and up to ten 2,000 megawatt reactors will be involved. The cores will be extremely radioactive. The fission product inventories established in your appendix tables E3 and E4 and must be treated with the utmost care and caution.

This amount of nuclear material, nuclear and radioactive material, is not mentioned by any of you. You have spoken about, like a few grams of high-level nuclear waste. Whom, gentlemen, are you kidding?

20
3.5
Okay, next item. The predicted personnel requirement of ten, of 100 during peak construction and 70 to 120 during test operations, that's unrealistically low.

My experience as facilities operations manager of my experiences as facilities operations manger of engine test one, during the Rover project nuclear rocket testing, tells

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me that the involvement of ten times the number of people would be required. This will be good for those folks who are proposing more jobs for Nevada. It is not good for the overall personnel exposure on a cumulative basis.

The environmental impact statement presents information on the amount of nuclear waste expected to be generated, 1.6 million cubic feet of low level waste, 70 cubic feet of mixed waste which the colonel stated is a mix of low level and other chemicals, an undefined quantity of unstable reactive transuranic elements, and this is my
21 8.1 estimate, correct me if I am wrong, over a ton of highly radioactive core material. You -- again, let me say, you gentlemen do not call it nuclear waste. Call it material, call it stuff, call it any other name, a rose by any other name is still a rose. This is one hell of a lot of very highly radioactive waste, period.

I am not related to the EIS, but a big concern to the taxpaying public is the question of cost. Various cost figures have been presented without too much consistency. The latest is reported in the August 14th issue of Las Vegas Review-Journal is stated to be 150 million in addition to the 130 million already spent.

This is the most ridiculously low-ball that I have ever heard. The Engineering construction and qualification testing costs of the effluent treatment

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systems, ETS, alone can usually run in the excess of 10 billion dollars. And I am speaking from experience as a resident manager of the primary containment system at the Nine Mile Nuclear Power Plant, Niagra Falls Power Corporation, the total plant, with existing technology, existing specifications to work from, ran out at more than six and a half billion.

The test to which your ETS system is split to is mind boggling. It's a primary containment. It's function is to separate, filter, absorb, condense out and what have you, 99 percent of the radioactive gasses and particulates from the reactor exhaust. I have only one more sentence to say.

22 12.5 Designing construction of this system must, as a minimum, meet the standards set forth in the Code of Federal Regulations of 1950, for nuclear facilities, Appendix A and
T 13.4 B, and that will govern your cost. It is for the above reasons that the sta'ed option of not to proceed with this project must be exercise[illegible] Thank [illegible]

COL. HUEPEL: Thank you. Now, let me ask, is there anybody in here who was out of the room when I called your name who is still waiting to speak? None.

Are there any other speakers? Okay. We've got one speaker here and we'll let him be the concluding speaker.

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Would you state your full name and where you are from?

MR. VIDANA: My name is Anthony Vidana. I got here at little late. I didn't get to see the presentation because I work at the Test Site and I got here as soon as I could. After I got off work it was about eight o'clock when I got here.

My understanding, this letter, is the proposal is between Nevada Test Site and Idaho. I worked at Tam, which is in northern Idaho, back in '75, when the, they were tapering off on the atomic airplane, they were still working on that at that time. I worked in the facility over here where they presently have the, the Test Site, where they do the nuclear testing and some of the other projects we had.

The thing I think you may have not taken into consideration is in Idaho, it's colder than hell. When I went down there, I am a facility engineer, so I have to service construction, construction costs are phenomenal during the wintertime, because you can't get things done. See this floor here? The ground is harder than that. You just can't do construction in the wintertime at all.

And other problems are, we used to ride the bus over to the Tam. We couldn't get to the Test Site or we'd be stranded sometimes at the test site for several days because of the weather. We used to get 30 below, maybe 40

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below, 60 below with the chill factor. In fact, our weather was colder than Alaska out there, and I was really amazed that the environment was so bad.

I don't know if that was taken into consideration, but I'm going to tell you, your scientists aren't going to work in that kind of environment. I didn't. That's why I got out of there. And I think you might take that into consideration, because you may have a little bit better time at Tam, if you've got some of the stuff already set up.

But we can easily do that over here, and we can construct it on a year round job and test it on a year round basis. They can't do that over there.

U 13.2 So I am, as far as the people who are there, I think they are probably as qualified as we are, but I think the people we have here have a lot more experience. They have been here a lot longer than up there. The reason I said that is because the weather is so bad, there's a big turnover. That's all I have to say. Thank you.

COL. HUEPEL: Thank you very much. There's one last speaker. Would you state your name, please?

MR. BABLICA: Nick Bablica. I've sat here for about three hours now, and I just have one question, and I want to give you gentlemen the rest of my five minutes to answer it. And I'd like a very specific answer I'd like you

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38 2.1 to go on the record. Please tell us simply, what is the purpose of this nuclear rocket? What is the purpose? What are we doing here? Why? Would you like to answer that?

LT. COL. BLEEKER: Let me try. The primary purpose -- you remember this is a technology program, the Air Force is interested in, for economic reasons, basically, to be able to lift things in space with smaller boosters. We talked of upper stages, second and third stages of rockets, what will transfer be, moving things from a lower orbit to a higher orbit. We can do that at less cost. We are talking in savings of billions of dollars with an investment of somewhere around a billion dollars.

In addition, and we really haven't went into too much else that this can be used for, but this kind of technology is also contemplated for NASA-type missions to Mars, now to planets. Conceivably, you could use this for power generation for commercial power. This kind of technology, I am talking about.

It could be used for things, you know, navy-type vessels, power for nuclear subs. It's basically a power reactor, a propulsion-type reactor. So the technology we are looking at --

MR. BABLICA: So, in other words, there's no specific, nothing specific at all what this whole project is for.

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I can answer your question, regard to the thing you brought up about the Mars. Later this month we are launching the Mars Observer and we are going to get there just fine without a nuclear rocket. So, I mean, there's no reason to go to Mars.

LT. COL. BLEEKER: Unmanned mission?

MR. BABLICA: Yes, an unmanned mission, which is what they should be, they should remain unmanned missions.

We don't need to send men to Mars. We can do it fine with robots. We can do it cheaper, without any potential loss of life. So the only answer I get, I don't get a specific answer yet. I mean, yes, we could do this, it could help submarines. What else?

LT. COL. BAUMGARTEL: Well, we have answered the question. That is in the report.

MR. BABLICA: Is there -- there is no specific reason, there is no specific purpose for this project, other than what was --

LT. COL. BAUMGARTEL: Yes.

COL. HUEPEL: I think the question has been answered.

Ladies and gentlemen, thank you for coming tonight. This hearing is adjourned.

* * * * *

(The hearing was adjourned at 10:15 p.m.)

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CERTIFICATE OF REPORTER

STATE OF NEVADA)
) ss.
COUNTY OF CLARK)

I, Harold St. Thomas, Certified Shorthand Reporter, do hereby certify: That I reported in shorthand (Stenotype) the proceedings had in the above-entitled matter at the place and date indicated. That I thereafter transcribed my said shorthand notes into typewriting, and that the typewritten transcript is a complete, true and accurate transcription of my said shorthand notes.

IN WITNESS WHEREOF, I have set my hand and affixed my official Seal in my office in the County of Clark, State of Nevada, this 15th day of September, 1992.

Harold St. Thomas
HAROLD ST. THOMAS, CSR NO. 130

NOTARY PUBLIC
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COPY

UNITED STATES AIR FORCE
PUBLIC HEARING

on the

DRAFT ENVIRONMENTAL IMPACT STATEMENT

for the

SPACE NUCLEAR THERMAL PROPULSION PROGRAM

at the

HOLIDAY INN, SABRA BALLROOM
850 South Bluff Street
St. George, Utah 84770

Thursday, September 10, 1992
7:00 o'clock p.m.

Hearing Officer	COL. JAMES HUEPEL USAF Judiciary
Proponent	LT. COL. GARY BLEEKER Phillips Lab
Environmental Program Manager	LT. COL. GARY BAUMGARTEL AFCEE-ESE
Cooperating Agency	MR. JOHN LEPPERT DOE/NV

AGENDA

Introduction	Col. James Huepel
Environmental Process	Lt. Col. Gary Baumgartel
Proposed Action	Lt. Col. Gary Bleeker
Environmental Impacts	Lt. Col. Gary Baumgartel
Comment Period	OPEN

Reported by: Harold St. Thomas, CSR No. 130

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COL. HUEPEL: Welcome to the public hearing on the Draft Environmental Impact Statement for the Space Nuclear Thermal Propulsion Program. Thanks for coming tonight. We welcome you to the meeting, to the hearing. We welcome your involvement and your participation and your comments tonight.

I'm Col. Jim Huepel, and I'll be serving as the presiding officer for this public hearing. I am the Chief Trial Judge for the Air Force. I am assigned to Bolling Air Force Base in Washington, D.C.

I'd like to introduce the other panel members here tonight.

In the middle is Lt. Col. Gary Baumgartel, who is the Chief of the Environmental Planning Division at the Air Force Center for Environmental Excellence at San Antonio, Texas.

To his left is Lt. Col. Gary Bleeker from the Phillips Laboratory at Kirtland Air Force Base, New Mexico.

Now, Col. Baumgartel will describe the environmental impact analysis process and the results of the environmental analysis. Lt. Col. Bleeker will brief you on the proposed action and the alternatives for the program.

Now, to my immediate left, is Mr. John Leppert, who is from the Department of Energy's Field Office in Las Vegas, Nevada. Now, The Department of

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Energy is what we call a cooperating agency in the program and has participated in the preparation of this Draft Environmental Impact Statement. And Mr. Leppert will be available to answer questions that you may have concerning the Department of Energy's involvement with this program.

As the presiding officer for this hearing, I'm not acting as a legal advisor for this action. I am not here as an authority on Draft Environmental Impact Statement, and I've not had anything to do with its development.

My purpose here tonight is to insure that we have a fair and an orderly hearing, and that everyone who wishes to speak has a fair opportunity to provide their input or to ask clarifying questions.

What I'd like to do at this point is to explain to you the public hearing process and the procedures that we'll be following this evening. Now, the Air Force has prepared a Draft Environmental Impact Statement, or you'll hear it referred to as a Draft EIS, on the Space Nuclear Thermal Propulsion Program. That was done in accordance with the National Environmental Policy Act and the Air Force implementing regulations.

And the purpose for this hearing is to summarize for you the results of the Draft EIS and receive your comments on the Draft EIS.

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Now, tonight's hearing will be in two parts. During the first part, Colonel Baumgartel and Colonel Bleeker will present information to you concerning the environmental impact analysis process performed for the Space Nuclear Thermal Propulsion Program.

The second part of the hearing is the public participation portion, where you will have an opportunity to comment on the Draft Environmental Impact Statement or to ask clarifying questions about it.

Now, this hearing is intended to provide a public forum for two-way communication about the Draft EIS, with the ultimate view being to improve the decision-making process. Your inputs ensure that the decision makers may benefit from your knowledge of the local area and any adverse environmental effects that you think may result from the proposed action or the alternatives to the action.

Let me say what this hearing is not. Despite what you might have heard on the radio, it is not a debate, nor is it a referendum. It's not a vote on the actions that have been analyzed in the Draft EIS. The focus of this hearing is on the environmental impacts associated with the proposals being studied by the Air Force. So comments on nonenvironmental issues should not be raised at this hearing.

Moreover, none of the panel members that we have

here tonight are the Air Force decision makers on the project.

Now, when you came in tonight you were provided with an attendance card, and you were asked to indicate on it if you wished to speak tonight or you were asked if you want to ask clarifying questions. After the presentations by Col. Baumgartel and Col. Bleeker, we'll have a short break, about fifteen minutes duration. Following that break you will have a five-minute opportunity each to speak or to ask clarifying questions, or both.

Now, if we have elected public officials here who wish to speak first, they will be called on, then the public at large.

Now, I'll randomly call on members of the public at large, using these cards. And I'll be doing it in a random fashion. I'll shuffle the cards up here so that everyone has a fair opportunity to speak first or to be the final speak r. If you have not filled out a card, or if, as we're going through the first part of the briefing tonight, you have some clarifying questions, if you'll hold up your hand, we've got some people that will give you cards, fill them out and turn them in, or hold them up and somebody will come and pick them up, or just fill them out at the break and turn them in so that they can be put in the stack for the people that I will be calling.

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Now, if you brought a prepared statement with you, you may read it out loud and you can put it in the basket at the podium, or you can do both. It will become a part of the public record.

Now, if you do not want to make an oral statement tonight, but you would like to provide your input, you may do so in writing. And for your convenience written comment sheets are available. If you didn't already pick one up you can get one at the break from the registration table.

Any comments that are made, whether they are given orally tonight or they are provided in writing, will be given equal consideration in the decision-making process.

In summary, I'd like to stress that this is your opportunity to provide the Air Force with any information you may have regarding environmental factors that are unknown to us and to have inputs into the decisions that the Air Force must make regarding the proposed actions.

Now, Col. Baumgartel will describe the environmental process.

LT. COL. BAUMGARTEL: Thank you, Col. Buepel. Good evening. I'm Lt. Col. Gary Baumgartel from the Air Force Center for Environmental Excellence at Brooks Air Force Base in Texas. Our organization is independently conducting the environmental impact analysis process for the

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Space Nuclear Thermal Propulsion Program.

Tonight I will present the schedule for completing this environmental impact analysis process, and show how the present public comment period fits into the schedule. I'll also discuss the scope of the study, and then Lt. Col. Gary Bleeker will present a briefing on the proposed action and the test location alternatives.

Lastly, I will present the results of our analysis.

On March 13, 1992 the Notice of Intent to Prepare an Environmental Impact Statement was published in the Federal Register.

Four scoping meetings were held in April, 1992 to receive comments from the public concerning the scope of issues to be addressed in the Environmental Impact Statement, or EIS.

After scoping, we collected the necessary data and conducted the analysis. The Draft Environmental Impact Statement we are here to discuss tonight was filed with the U.S. Environmental Protection Agency on August 14, 1992.

The public comment period will extend until October 5th of this year. The final EIS is scheduled to be completed in December of 1992. Once complete, the EIS will be used by the Air Force to help decide whether or not to proceed with the test program to validate the concept behind

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the Space Nuclear Thermal Propulsion program. We expect to accomplish the record of decision in January, 1993.

A copy of the Draft EIS was mailed to all groups and individuals who requested one. In addition, these libraries in the state have a copy available for review. Also, a copy may be requested tonight or by writing to us at this address.

In addition to tonight's hearing, written comments on the Draft Environmental Impact Statement will continue to be accepted at this address until October 5th. After the comment period is over, we will evaluate all comments, both written and oral, and perform additional analysis or change the Environmental Impact Statement where necessary.

Again, as in the scoping process, equal consideration will be given to all comments, whether they are presented here tonight or received prior to the October 5, 1992 date. Comments received after October 5th may not be considered in the final Environmental Impact Statement because of schedule constraints.

Once the review process is complete, we will produce a final Environmental Impact Statement and mail it to all those on the original Draft Environmental Impact Statement distribution list, as well as those who request a copy between now and the mailing date.

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The final Environmental Impact Statement will include comments received during the public review period and our responses to those comments.

Following completion of the EIS, the Air Force and DOE will consider Environmental Impacts, as well as other factors, such as economic and technical considerations and program goals, before deciding whether to proceed with the SNTP program. The decision will be documented in a record of decision.

Now, I would like to present Lt. Col. Bleeker from the Phillips Laboratory, who will describe the Air Force's proposed plan for the Space Nuclear Thermal Propulsion Program.

LT. COL. BLEEKER: Good evening, ladies and gentlemen. I'm Gary Bleeker. I'm the program manager for the Space Nuclear Thermal Propulsion Program at the Air Force's Phillips Laboratory in Kirtland Air Force Base in New Mexico.

Tonight I'd like to tell you about the Space Nuclear Thermal Propulsion Program and our proposal to develop and to validate the particle bed reactor propulsion technology.

The SNTP program's mission is to develop and to validate nuclear reactor technologies with potential application to advanced space propulsion systems. Several

propulsion technologies have been and continue to be considered as viable research options. However, the Air Force considers the particle bed reactor propulsion technology to have sufficient developmental potential to warrant continued investigation.

Before we go any further, I'd like to explain how the SNTP program was formed. Approximately two years ago work was begun on an Environmental Impact Statement to support certain decisions concerning a classified program, and particle bed reactor technology was one of the state-of-the-art technologies being developed under this program.

However, because the program was classified, the Environmental Impact Statement was likewise classified, and prepared without public participation. Because of changing mission requirements, the program, Code named Timberwind, was terminated.

The Air Force, however, recognizing the potential of the particle bed reactor concept, took over the responsibility for developing the particle bed reactor.

The SNTP program office was formed in 1991 to lead and manage the development effort. In assuming this responsibility, the Air Force determined that rather than to rely on the classified Environmental Impact Statement, about which the public knew nothing, we would prepare a new

Environmental Impact Statement for the program with full public participation.

In short, the Air Force wants to fully develop and validate the particle bed reactor technology that was started under the Timberwind Program. The Air Force goal is to demonstrate the feasibility of a particle bed reactor propulsion system that could be operated outside the atmosphere in space as an advanced upper stage or an orbital transfer vehicle.

As stated in the Notice of Intent, the decisions to be made, based in part on the this EIS, are:

A. Whether to continue the SNTP program through the development of nuclear thermal propulsion technology.

B. Whether to construct and operate a validation test facility. And

C. Where to locate the validation test facility if the program is to continue.

Two sites are being considered for locating the validation test facility, and both were studied in the Environmental Impact Statement. One is at the Nevada Test Site, and the other is at the Idaho National Engineering Laboratory.

When this environmental analysis was begun, a third site called Quest , also at the Idaho National

Engineering Laboratory, was under consideration. However, as a result of our investigations, it was eliminated from further consideration due to the presence of significant cultural resources.

Before we get into the details of the program and specifics of our proposed action, I'd like to provide a lay person's description of conventional chemical and nuclear propulsion systems and why the promise of nuclear propulsion is so profound.

First, the ultimate objective of any propulsion system is to produce very hot gas for propulsion.

In a conventional chemical propulsion system, two fluids, a fuel and an oxidizer, are mixed and then burned. When proper combustion occurs, a large volume of hot gas is generated. The hot gas is expanded through a nozzle to produce thrust.

However, there are but a few acceptable fuel and oxidizer combinations. The efficiency and performance of chemical propulsion systems are limited by both temperature and the molecular weight of the gas after the combustion process is complete.

A nuclear propulsion system contains a reactor, which replaces the combustion process in a conventional propulsion system.

Thus, the reactor essentially becomes a very

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powerful heater, heating a single fluid, the propellant, to very high temperatures. The propellant flows through the reactor, becomes very hot, is expanded through a nozzle and produces thrust in the same manner as a conventional rocket.

Both chemical and nuclear propulsion system temperatures are limited by the material capabilities, which limit operating temperature to about 5,000 degrees Fahrenheit.

But the key difference between the two propulsion systems is that with a nuclear propulsion system we can choose the propellant. By choosing the lightest propellant, hydrogen, a nuclear propulsion system can be made more than twice as efficient as a conventional one.

While that is a very significant result, its effects are even more dramatic because propulsive efficiencies work in a very special way. The theoretical effect of doubling the propulsive efficiency is that the load-carrying capacity could be increased by 8 to 10 times.

However, as a practical matter, we can see real cost and weight reduction by a factor of 2 to 5. This means a tremendous monetary savings if a safe, high performance nuclear propulsion system can be developed.

One nuclear technology, called Particle Bed Reactor, or PBR, is viewed by the Air Force and others

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as having distinct performance advantages.

The PBR would use spherical fuel particles. A typical fuel element would contain many millions of these fuel particles, each approximately 1/2 millimeter in diameter, or a grain of sand. A typical particle contains a kernel of fully enriched uranium-235, surrounded by a porous graphite buffer layer. Next is a high-density graphite layer, which is surrounded by a final layer of zirconium carbide.

These multiple coatings provide containment of fission products and prevent the heated hydrogen from damaging the kernel material.

Each hexagonal fuel element includes a neutron moderator material on the outside, a set of concentric frits, or filters, and the fuel particles themselves. The concentric frits are devices that structurally support the fuel particles while allowing hydrogen to flow through the material and cool the fuel particles. Flow paths through an element are those illustrated in this figure.

The entire fuel element assembly would be surrounded by a neutron reflector, such as graphite or beryllium, to enhance reactor performance. The particle bed reactor configuration under consideration consists of a closely packed array of hexagonal-shaped fuel elements, which you see here, surrounded by neutron moderating and

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reflector materials and then reactor control devices.

The use of an array of hexagonal fuel elements allows the option of a modular design, where the number of elements could be tailored to produce the desired thrust. To your right is the engine, there.

The general concept of an engine, or a propulsion system involves the use of the particle bed reactor to heat low temperature liquid hydrogen to very-high-temperature gaseous hydrogen. The hot hydrogen is not burned, but simply exhausted through a nozzle to produce thrust.

The major goals of the SNTP program include the achievement and control of predicted nuclear power levels, the development of materials that can withstand the extremely high operating temperatures and hydrogen environments, and reliable control of low- and high-temperature hydrogen propellant.

In addition to the particle bed reactor itself, the principal components of a conceptual propulsion system are the propellant management system, and the pressure vessel/nozzle assembly.

The propellant management system provides controlled flow and pressure to the reactor and other subsystems. The propellant management system also contains provisions for tank pressurization and conditioning of fluid

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paths. During operation, low temperature hydrogen exits the propellant tank and enters the pump section of the turbopump assembly.

After exiting the pump, the propellant is delivered to the reactor, where it is heated to the desired temperature. A small portion of the propellant is bled off to power the turbopump itself, and the balance is subsequently expanded through the nozzle.

The pressure vessel/nozzle assembly would provide pressure containment and structural support for the particle bed reactor and collect hydrogen gas from each reactor fuel element and accelerate the gas through the throat section of the nozzle to generate thrust.

This leads to the description of the proposed validation testing of the particle bed propulsion technology. The proposed testing would demonstrate the technology through a series of tests over a 5- to 10-year period leading to the validation of the particle bed reactor concept.

As shown in this slide, the tests are sequenced to begin with fuel element testing, over on the left, and culminate in testing of integrated systems. Specifically, the test series includes the particle bed integral performance element test, which we call PIPET and the engine integration tests (EIT) as well as tests of ground test

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articles, or complete engines. All these tests would involve reactors fixed within a test cell and within properly contained facilities.

Each test series would be carefully planned to include written procedures and formal review and approval. Each test sequence would undergo a comprehensive safety analysis before approval to proceed could be granted.

The multiple fuel element tests, or what we call PIPET, would be the first self-sustained, power-producing particle bed reactor test. These tests would involve a reactor about the size of a 55-gallon drum, and would be used to demonstrate the performance, operability and reliability of the fuel elements developed for the SNTP program.

Each of the nuclear cores involved in these tests could be subjected to five operating cycles at a maximum power level of 550 megawatts for as long as 500 seconds each cycle. This is the energy equivalent of a Boeing 747 flying for 40 minutes. Up to ten of these tests may be conducted in a year.

Nonnuclear turbopump tests, or what we call engine integration tests, would be designed to demonstrate the proper function of the propellant management system without an operating reactor in the loop. A mock-up of the entire system would be tested using a gas generator system

to produce hot hydrogen to power the turbopump for checkout. This series would establish confidence in the control and in the propellant feed system necessary to allow proceeding to the engine system tests.

The integrated system tests, or what we call ground test articles, would be a series of up to ten reactors which gradually approach the desired performance conditions. The ground test article design would evolve from technical information derived during earlier testing.

These tests would, through a progressively expanding test program, expose the system to the full performance profile values of temperature, pressure, flow rate, and nuclear radiation fields. Two versions of these ground test articles would be tested. They are referred to as mini-GTAs and full-scale GTAs.

When satisfactory operations are associated with the earlier PIPET testing, mini-GTAs would be tested in the same small facility.

The full-scale engine test series demonstrating a complete particle bed reactor operation with feed and control hardware and a full complement of instrumentation. The full-scale system would approximately be the size of a small automobile.

Multiple tests would be performed on each of the full-scale GTAs. The tests would build up from zero power,

to low power, to operational power and temperatures. These tests would demonstrate controllability and stability at full power and the rapid start-up and shutdown under computer control needed for a simulated full mission profile.

Each test would be in order of a few minutes in duration. The maximum time of a full power reactor, which in this case would be 2,000 megawatts. For any individual core assembly, it would be approximately 1,000 seconds. The energy produced from such a test would be equivalent to a Boeing 747 flying for approximately four and a half hours.

Because no facility exists that fully meets testing requirements, construction of a new test facility or extensive modification of an existing facility is required.

Next slide.

As shown on this slide, the main features of a sub-scale facility would include a control complex, including instrumentation and control system, a test cell, a confinement system, a coolant supply system and an effluent treatment system.

The control complex would be a shielded, reinforced concrete building from which access to the facility, activities involving the test cell, and a system to provide video surveillance over the entire test facility would be controlled.

The control system would provide required safety and control functions for all operations at the facility. The system would provide remote control of all functions associated with the test systems.

In addition, it would give visual indication of critical system parameters and status to assure safe operations during all phases of the experimental programs.

The sub-scale facility would include a test cell to accommodate the major components of the reactor for the initial validation tests.

The confinement system would be provided to limit the release of fission products and would include a barrier, enclosing the reactor and portions of the effluent treatment system.

The process fluid systems for both the sub- and full-scale test facilities would consist of two major sub-systems: The coolant supply system, and the effluent treatment system.

The coolant supply system would be composed of the hydrogen storage system, the helium storage system, and the pipes and valves for distributing that coolant.

There are three major reasons for incorporating an effluent treatment system in the test facility.

First, one of the goals of the testing is to validate design margins. The potential for releasing a

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larger quantity of fission product increases as the operating parameters approach these limits.

The emissions of radionuclides into the ambient air from DOE facilities are regulated by the Environmental Protection Agency in accordance with the National Emission Standards for Hazardous Air Pollutants, which specifies that the emissions shall not exceed an amount that would cause any member of the public to receive, in any year, an effective dose equivalent to 10 milliroentgen equivalent man, or millirems, per year.

While the National Emission Standards may allow a member of the public to receive a dose of 10 millirems in a year, the SNTP program would be committed to a design goal of 2 millirems per year, or 20 percent of the allowable regulatory limit.

Second, because the SNTP program is a developmental program, there would be some uncertainty in actual composition of the effluent. An effluent treatment system would ensure that the emissions from planned activities would remain within the program goals under all postulated routine operating scenarios.

Third, it is a national policy to reduce radioactive discharges to a level that is as low as reasonably achievable.

The ETS would be designed to accomplish the

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following objectives:

1. Ensure that the radioactive material entering the effluent treatment system remains in a sub-critical geometry.
2. Cools the test article effluent to temperatures acceptable for normal engineering materials used in gas treatment systems.
3. Remove particulates, debris, halogens, noble gases and vapor phased contaminants from the effluent stream. And
4. Flare the resulting hydrogen gas to the atmosphere to prevent the accumulation and potential detonation of the hydrogen in the vicinity of the test cell.

An effluent monitoring system would measure the radioactive and particulate content of the discharge stream on a real-time basis. This would alert the operator to releases of radioactivity and/or approaching any prescribed limits.

The effluent treatment design would also include appropriate shielding to prevent worker exposure to ionizing radiation above acceptable levels.

Construction and/or modification of facilities

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is expected to take approximately 18 to 24 months for both the sub-scale and the full-scale test facilities, with an average work force of about 35 and a peak work force of about 100.

The number of personnel on site during pre-operational activities at the sub-scale facility would be limited to about 30 security, technical, administrative and maintenance personnel. The pre-operational staff of the full-scale facility would be somewhere between 50 to 60. During actual testing operations for both facilities, the number of personnel on site would be reduced to a minimum operating staff of no more than 10 individuals, all of them located within the control complex.

The resulting population increase in the region would be approximately 70 as a result of sub-scale operations and 120 as a result of the full-scale operations.

Two sites at DOE installations have been identified as suitable locations for the particle bed validation test facility: The Saddle Mountain Test Station site at the Nevada Test Site and the Contained Test Facility site at Idaho National Engineering Laboratory.

The principal exclusionary criteria considered in the site-narrowing process were:

1. Similar nuclear activities conducted at the installation.

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2. Fifteen kilometers minimum distance to the nearest urban area. And
3. Federal ownership of the facilities

Next slide.

The Saddle Mountain Test Site is located in the center of the Nevada Test Site, south of Mine Mountain Road and west of Saddle Mountain Road. The distance to the nearest boundary is 14 miles, and access to the Nevada Test Site is controlled.

Saddle Mountain Test Site would require new construction for both sub-scale and full-scale test facilities. Other infrastructure required for the site includes power lines, phone lines, roads, a deep water well, and water storage tanks. Transportation improvements would include new site roads and the grading of the existing access roads.

The contained test facility is located in the northern portion of INEL, or Idaho National Engineering Lab, northeast of the intersection of Lincoln Boulevard and State Highway 33.

Some existing facilities to support validation testing are already located at the Contained Test Facility site.

Existing facilities consist of a receiving, assembly and hot cell facility, a containment structure, a

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control bunker, post-radiation examination facilities and administrative space.

An approximate one and a half mile railroad track connects the containment structure to the receiving, assembly and hot cell facility. A security fence with guard stations is also in place.

A number of modifications to the existing facility would be required. It is likely that the control building would have to be reconfigured to accommodate the tests, and the receiving, assembly and hot cell facility may require modest modification to accommodate the hot test articles.

Engineering studies have been initiated to determine if the Contained Test Facility or whether new test cells would be required for the full-scale test. New test cells, if required, would be located adjacent to the Contained Test Facility.

Use of the containment structure as the test cell would require construction of process fluids storage and piping, the effluent treatment system and the flare stack. Engineering studies are underway to determine renovation requirements for the Contained Test Facility vessel.

As required by the National Environmental Policy Act, the no-action alternative was also evaluated. The

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no-action alternative would result in the Air Force not proceeding with the particle bed reactor development and the validation testing program.

What I have presented here is a summary of our proposal to develop and validate the PBR propulsion technology. Many more details of the proposed action are contained in the Draft Environmental Impact Statement.

Lt. Col. Baumgartel will next present the environmental impact analysis for this program.

LT. COL. BAUMGARTEL: This Draft Environmental Impact Statement was prepared to comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Efforts were made to reduce the needless bulk, to write in plain language, focus only on those issues that are clearly related to the environment, and to integrate the EIS with other documents required as part of the decision-making process.

The analysis focuses on impacts to the natural environment that may occur as a direct result of the particle bed reactor development and validation testing, or indirectly through changes in the community.

Resources evaluated are air quality, biological resources, cultural resources, soils and geology, noise and water, both surface and groundwater, indirect changes to the community that provide measures against which environmental

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impacts could be analyzed including changes to the local employment and population, land use, aesthetics, transportation, and finally, utility services.

In addition, issues related to the current and future management of hazardous materials and waste are discussed in the document. Because the proposed action involves transportation and testing of nuclear materials, a considerable amount of health and safety analysis was done to address radiological as well as nonradiological impacts.

If, as a result of our analysis, it was determined that adverse environmental impacts may occur through implementation of the proposed action and testing alternatives, the potential mitigation measures were identified and analyzed in the document as well.

I would now like to present the results of our analysis that are presented in the Draft EIS. Both validation test site locations were analyzed at the same level of detail. The baseline conditions assumed for the purpose of analysis are the existing conditions at each location. The following slides will show the comparative impacts between the test site alternatives, excluding the no-action alternative.

This slide shows the maximum projected population and employment effects from the implementation of the SNTP program. A peak year increase of 100 employees,

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assuming for purposes of determining maximum impact, that no persons from the local job market would be employed, results in only a 0.04 percent population increase in the region of influence for SNTS, or a 0.2 percent, or two-tenths of a percent, increase in the region of influence for CTF.

AN UNIDENTIFIED WOMAN: Pardon me, could you speak up? We can't hear you back here.

LT. COL. BAUMGARTEL: Going back to the slide, peak increase of 100 employees assumed for purposes of determining maximum impact with no persons from the local job market would be employed, which results in a .04 percent population increase in the region of influence for the SNTS, and a 0.2 percent increase in the region of influence for CTF. A maximum of 2 percent increase in total peak year employment would occur at NTS, or a 1 percent increase at INEL.

This slide shows the utility requirements for the SNTP program at the two alternative sites.

Under energy, there is sufficient power at both SNTS and CTF for sub-scale testing. Supplemental power would be provided by mobile generators at the SNTS during ground test article operational testing. Mobile generators may be required to provide supplemental power during peak demands of ground test article operational testing at the CTF.

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Under solid waste, an average of 175 tons per year of nonhazardous waste is expected from the SNTP program. At the NTS this is less than 2 percent of the total amount of solid waste generated, and would result in a negligible increase in the anticipated life of the disposal capacity.

At the INEL, a new landfill will be operational by 1995. Therefore, a negligible impact on the landfill capacity is expected here.

Under wastewater, at SNTS, the total estimate of 2,400 gallons per day of wastewater would be handled by a new septic system planned for the, into the SNTP facility design. An additional 2,400 gallons per day of wastewater at CTF would be well within the capacity of the existing evaporation pond system.

Under water supply, the 0.01 million gallons per day of water demand for SNTP represents a small increase in demand on the water supply systems at either the NTS or at INEL.

The construction of facilities on 100 acres at SNTS is consistent with current missions and activities at NTS, and no land use impacts would occur. The modification of existing facilities and construction of additional facilities at CTF is consistent with current missions, also, and activities at INEL, and no land use impacts would occur

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at that site, either.

This slide shows the traffic impacts of increased employees travelling to either NTS or INEL. A maximum of 5.9 percent increase in traffic is expected along U.S. 95 to NTS for construction and a maximum of 3.5 percent increase during operations.

Assuming that most employees at INEL would use commuter buses to get to work, the SNTP program would cause a 4 percent increase in traffic during construction and a 3 percent increase during operations on State Route 33. None of these traffic increases is expected to cause adverse impact to the level of service of these roads.

The next two slides cover the transportation and use of radioactive and nonradioactive hazardous materials, and the storage and disposal of hazardous wastes. Health and safety aspects of hazardous materials and wastes will be discussed shortly.

Under hazardous materials, the largest quantity of fuel material to be transported in a single shipment would be the reactor cores. The Department of Transportation, the Department of Energy, and Nuclear Regulatory Commission regulations and requirements would be followed to ensure that no adverse impact from these and other transportation activities. These precautions would be required for either the SNTS or the CTF sites.

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Under nonradioactive hazardous waste, approximately 500 cubic feet, or seventy 55-gallon drums, of nonradioactive hazardous waste, consisting principally of solvents, would be generated from either site over the life of the program. All waste would be labelled and shipped to an EPA-permitted treatment, storage and disposal facility.

Under low level waste, low level radioactive waste requiring disposal would consist of solid wastes from handling, cleaning and disassembly of canister assemblies and contaminants removed from the effluent stream.

Over the life of the project, it is anticipated that 1.6 million cubic feet of low level waste would be generated. This low level waste would consume 18 percent of the available disposal capacity at NTS, or 46 percent of the available disposal capacity at INEL.

Under mixed waste, mixed waste, such as low level radioactive materials contaminated by solvents or solvent residues may be generated. It is anticipated that no more than 70 cubic feet of mixed waste material would be generated annually.

The NTS has sufficient capacity for storage and disposal. INEL has sufficient capacity for storage, and is awaiting permitting of a disposal facility.

The disturbance of ground and construction of facilities at SNTS or at CTF would generate some fugitive

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dust, which is regulated under the National Ambient Air Quality standards as particulate matter, and there would be emissions from construction vehicles.

Emissions from the operational phase would include emissions from additional traffic and from minor site activities, such as the use of diesel generators and the flaring of hydrogen during particle bed reactor tests.

The impact on regional and local air quality from either the SNTS or the CTF alternative would be negligible and is not expected to affect the attainment status of the region.

This slide summarizes the impacts to biological resources from the project at the two alternative sites.

At SNTS, there would be a loss of 100 acres of Transitional Desert Association Habitat, which is a common community. Construction of the facilities and improvements to access roads may impact up to 1,000 Joshua trees.

From project operations, noise may affect wildlife, and the flare stack would kill any birds flying into the flame. However, the noise from the flaring would very likely scare the birds away that might fly over the flare stack area. No impacts to the threatened or endangered species are expected.

At the CTF, there would be a loss of less than 50 acres of previously disturbed land that is low quality

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habitat. Project operations, that is, again, noise and the flare stack operations, would have similar impacts as at the SNTS.

The only threatened and endangered species, the bald eagle, has been observed approximately 12 miles from the CTF and foraging near the mountains north and west of INEL. The only possible impact would be from the flare stack. This is considered unlikely because of the distance, noise from the flaring operation, and the intermittent nature of the flaring operation itself.

This slide summarizes the results of the cultural resources analysis for the two alternative sites.

At SNTS, seven prehistoric sites were found within the region of influence. None of these sites is considered significant under the National Register criteria. Therefore, no adverse impacts are expected to occur to archeological resources. No historic, native American or paleontological resources have been identified at SNTS.

At the CTF, the only known cultural resource that may be affected is the existing facility at the CTF, which retains qualities that would make it potentially eligible for the National Register of Historic Places. This is because the CTF is the only nuclear reactor test facility of its size in the world designed to simulate all of the important events that could occur in a commercial

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pressurized water reactor power plant.

Consultation between the Idaho State Historic Preservation Office, the Advisory Council on Historic Preservation, and INEL is addressing the issue of National Register eligibility for several INEL properties. A memorandum of agreement to outline various mitigative requirements is currently being prepared.

Until the consultation process determines the eligibility of the CTF for the National Register, it will be considered a potentially significant historic resource. As such, modifications proposed by SNTP could have an adverse effect.

Mitigation measures may be required if this site alternative is chosen. If it is determined that the CTF is not eligible for the National Register, then no cultural impacts are expected.

Under geology and soils, the construction of new facilities would require disturbance of 100 acres of land for the SNTS, and less than 50 acres for the CTF. The SNTS would require 28,000 cubic yards of material for cut and 37,000 cubic yards for fill, while the CTF would require 3,000 yards for cut and 4,000 yards for fill.

Measures would be taken at either site to suppress dust and soil erosion. No impacts from seismic or volcanic activity are expected.

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High noise levels at SNTS are not expected to cause impacts to nonproject personnel. The projected 125-decibel noise level from operations would be attenuated before reaching nonproject personnel and sensitive community receptors. The nearest nonproject personnel would be approximately six miles away, and the nearest community is approximately 23 miles away.

Noise levels at the CTF are also not expected to impact nonproject personnel and sensitive community receptors. The nearest nonproject personnel are approximately 1.3 miles from the CTF and the nearest community is approximately 11 miles away.

There would be a short term noise effect on wildlife in the immediate vicinity of the test facility during test operations. This may have a beneficial side effect of scaring the birds away from the flare stack while operations are occurring.

The 3.7 million gallons per year of water required for the project are not expected to cause draw down in the aquifers at either SNTS or the CTF. No water quality impacts are expected from normal operations.

Turning to health and safety, this slide is a chart showing results from maximum case radiological modeling of normal testing operations as compared to the National Emission standards, the program goal, and the

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radiation dose we receive naturally.

In summary, the SNTP program exposures to the maximally exposed public are much smaller than the annual regulatory limit for routine exposures. These calculated exposures are also considered smaller than the annual exposure through naturally occurring radiation.

For the NTS area, the maximum single year exposure would be 0.6 millirem, which is 0.14 percent of the naturally occurring exposure. For the INEL area, the maximum single year exposure would be 1.35 millirems, which is only 0.31 percent of the naturally occurring radiation.

These doses represent the upper bounds on the potential exposures and have been calculated using extremely conservative methodology. In summary, no adverse radiological impacts are expected as a result of the proposed action.

This slide shows the results from radiological modeling of the maximum case credible accident scenario. The maximum case credible accident is assumed to consist of a simultaneous failure of two critical ETS components, resulting in a release to the environment.

In developing the maximum case effects shown here, all weather conditions were looked at and consideration was given to multiple concurrent internal and external explosions of hydrogen.

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The maximum credible accident exposure at NTS would be 23.5 millirems, or only 5.6 percent of the natural dose. The maximum credible accident exposure at INEL would be only 30 millirems, or 6.8 percent of the natural dose.

In comparison, the recommended maximum 24-hour accident exposure level is 500 millirems, or more than 15 times the maximum accident exposure at either site.

As with normal operations exposures, the maximum accident exposures represent the upper bounds, using extremely conservative methodology. Also, the analysis does not include mitigation measures such as evacuations and remediations which would be undertaken in the event of an actual accident.

Looking at worker exposures, the Department of Energy suggests a design goal of a maximum 500 millirems annual dose for radiation workers. The 150 workers at the SNTP facility could, therefore, be exposed to as much as 750,000 person-millirems over the ten years of the SNTP program and meet this goal.

Also, the goal of the SNTP program is to maintain exposures to on-site nonprogram related personnel to a much lower level of only 20 millirems per year.

Based on this goal, the 4,500 workers at NTS could receive up to 900,000 person millirems, or only 4.7 percent increase over the natural exposure levels of 19

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million person-millirems which would be received during the ten-year period of the SNTP program.

The 8,500 workers at INEL would receive not more than 1.7 million person-millirems, or only a 4.5 percent increase over the natural exposure levels of 37.5 million person-millirems received in the ten years of the SNTP program.

In the area of chemical safety, the SNTP program would use several liquid and gaseous chemicals in support of the program. Hydrogen is classified as a simple asphyxiant, and its greatest hazard is from its extreme flammability range, which can lead to fires or explosions.

Oxygen, although not flammable itself, supports and accelerates combustion. Nitrogen and helium, again, are simple asphyxiants and nonreactive.

Numerous facility designs and handling procedures would be established to ensure that these hazards are minimized when using these chemicals. These designs and procedures will be implemented to ensure the hazards are minimized.

There are no site specific issues with the SNTS site in terms of chemical safety.

Use of the CTF for testing purposes may allow the build-up of hydrogen inside the facility during test operations. Following test completions, venting of the

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structure would be required before personnel could enter, to reduce the potential of explosion or asphyxiation.

Several analyses were performed that considered potential impacts from the transportation of radioactive materials.

For the nonaccident case of transportation of radioactive materials to the NTS, the calculated total population dose received for the program duration would be 113,000 person-millirems.

In addition, only 0.94 person-millirems are projected as a result of anticipated transportation accidents. For nonaccident transportation of radioactive materials to INEL, the calculated total population dose for the program duration would be 132,000 person-millirems, with an additional 1 person-millirem projected as a result of anticipated transportation accidents.

In all cases, the population dose would be distributed among a large total population, with no member of the public receiving doses in excess of 1 millirem, and the majority of exposed individua' receiving a total dose which is immeasurably low.

Beryllium is under consideration for use in the particle bed reactor. Inhalation of beryllium particles may lead to bronchitis and pneumonia, and it is a suspected carcinogen. The only likely release of beryllium would be

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from a catastrophic failure. However, no credible accident scenario is conceivable that could produce considerable amounts of beryllium.

Based on a maximum case release, the total exposure to any individual would be no greater than three ten-thousandths of a milligram. This exposure would be more than 50 times less than the Occupational Safety and Health Administration permissible exposure limit of 173 ten-thousandths of a milligram in a 24-hour period. Therefore, beryllium release is not expected to be a significant impact under any circumstances.

This completes my review of the Draft EIS. Our goal is to provide the Air Force decision-makers with accurate information on the environmental consequences of this proposal. To do this, we are soliciting your comments tonight on the Draft EIS.

At this time, I'd like to turn the meeting back over to Col. Huepel.

COL. HUEPEL: Ladies and gentlemen, let's take a 15-minute break. Before we do I just remind you, if you haven't filled out a speaker card and you'd like to speak tonight or ask any clarifying questions, go ahead and pick one up and fill it out at the registration table and turn it in before you come back in.

(A recess was taken.)

COL. HUEPEL: If you would like to speak or have some clarifying questions you'd like to ask, just go ahead and raise your hand and we'll get a card to you or the cards are out at the registration table, and then we'll get them -- raise your hands with the cards so we can get them picked up so they can bring it up to me.

I encourage you, if you have a statement that you'd like to make, to go ahead and do it. Don't be shy or hesitant. I want to ensure that everyone who desires to speak tonight will have a fair chance to be heard.

We do have a court reporter with us tonight who is taking down word for word everything that is said during the hearing, and then this record will become a part of the final environmental impact statement and the decision package.

I would appreciate it if you would help me with the following rules.

I will announce the name of the first speaker, and then I will also indicate the name of the next speaker, while the first speaker is coming to the podium, or at the podium, the next speaker, if you'd come over here to this far wall, there's a chair here. If you'd go ahead and come on up here, that will make it quicker in terms of being able to get people up and down. Because right now I've got about 38 speakers and the quicker we can get people up and down,

the better the chance that you'll have to be able to make your statement.

So I'll go through. I'll try to keep up announcing the next speaker as we're calling the actual speaker to the podium.

Second, please speak only after I recognize you, and address your remarks to me, or address your questions to me. If you have a written statement that you'd like to submit tonight for the record, go ahead and place it in the basket on the podium, if you would.

And, as we've said before, if you prefer to send written input in later on, that's fine, too.

Third, I'd ask you, when you start speaking to go ahead and speak into the microphone. If you're short like I am, you may have to pull it down, or if you're taller, go ahead and pull it up, so that we can try to get the volume right.

If you would also state your name and what city you are from and the capacity in which you are speaking, whether you are an elected official or whether you are representing a group, a public interest group, or whether you are speaking as a concerned citizen.

Fourth, I will recognize each person for five minutes. And we've got to have that time period so that everyone will have an equal opportunity to be heard this

evening. So please honor any request I make for you to stop speaking or to stop asking questions.

Basically, when five minutes comes up I'll hold my hand up. So you've got to keep watching me, and when you see my hand up, if you'd go ahead and conclude your remarks.

If you have more comments than you will be able to present in five minutes, please priortize your comments, so that you can get your most important points in first. And, of course, remember that you can submit as much written comments as you want to submit.

And with the number of speakers that we've got, we'll be having a break, somewhere probably about an hour, an hour and a half from now.

And if I call somebody's name and they're not here, I'll call the name after the break and if they're still not here, then I won't call the name again.

And the last thing, I just ask the entire audience to be courteous and to not talk while the recognized speaker is speaking or while questions are being answered.

And with that, I'll start the random selection, because we've had no one indicate that they wanted to speak first as an elected official. So the first speaker tonight will be Nelson Williams.

MR. WILLIAMS: All right.

COL. HUEPEL: The second speaker will be Edwin Leigh.

And if I mispronounce your name, I apologize in advance. With a name like Huepel, I'm used to getting my name mispronounced, so I'm sorry if I do that. Dr. Williams.

DR. WILLIAMS: Thank you.

I'm here representing myself, and my family.

COL. HUEPEL: Sir, if you could just go ahead and look at me and speak into the microphone.

DR. WILLIAMS: Mainly, I am here as a concerned citizen. My family has lived in the area for sometime now, and we consider ourselves St. George natives, nearly.

1 In the past I have been involved in biological research on the NTS and surrounding areas. I have one publication, a very minor publication on the effects of fallout on the native plants in the area, actually, the
12.7 accumulation of radiation in the native plants. I didn't get the effects. I had a small research grant and it didn't go too far.

I collected other data besides what was published, and I have been carrying it around with me for twenty years or more, and have done very little with it. But I was concerned in that, in past tests from the Test Site, even though some of the emissions from the test were

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1 cont'd quite small, that these things accumulated biologically to the point where they could be hazardous to individuals.

12.7 Earlier tests, of course, were hazardous to individuals themselves. But, I really am opposed to anything more being added to our local environment around here. I am not -- proposed research is intriguing and I wouldn't object to that being done someplace other than where it affects southern Utah.

I think, really, that's the basic part of my statement. I'm not concerned about my family. I am not just concerned because of scares or things. I am concerned out of knowledge. I'm concerned out of knowledge and studies that I have done and studies that other people have done. I, probably, until 15 years ago, read everything that was published, French, German, Russian, Chinese, Japanese, whatever, on the effects of the radioactivity on lending organisms and any is too much in my estimation. I thank you.

COL. HUEPEL: Thank you, sir. After Mr. Leigh will be Rhonda Chertkow. I am also going to ask you, whichever side you are on, if you would withhold your applause, again, trying to get people up and down so everybody can speak. Yes, sir.

MR. LEIGH: I am Edwin Leigh, from Cedar City, Utah. I'm a retired biology teacher. I taught school for

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22 years in Cedar City. I have two good friends and neighbors that died of cancer just after the testing in Las Vegas with the atomic bomb. The doctor couldn't prove, but he was sure that they died because of the radiation that came over southern Utah.

In fact, the media told us to go out and watch the cloud come over as it did, a big pink cloud. And we all went out and dismissed their classes from school and watched the cloud come over Cedar City and St. George. And I can't prove, but am sure that they died because of the radiation that came over there.

A 13.4 I'm against any form of testing radiation of any kind, and I think there's other ways we can he bring peace to the world. And I'm totally against it and I would do anything I could possibly do to prevent it. Thank you

COL. HUEPEL: Thank you, sir.

COL. HUEPEL: Is Rhonda Chertkow here? Okay. Apparently not right now. Lee Daniels. After Lee Daniels will be Norene Mackley. Is Lee Daniels here? Lee Daniels is not here?

MS. MACKLEY: I am.

COL. HUEPEL: Okay. Norene Mackley. And after her will be Margaret Whitwood. Ms. Mackley.

MS. MACKLEY: Colonel, I would like --

COL. HUEPEL: If you could go ahead and speak

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into the microphone.

2 2.1 MS. MACKLEY: I would like to know what your reason is for these tests. Why are they being pursued?

COL. HUEPEL: Col. Bleeker, are you the best one to answer that?

LT. COL. BLEEKER: Sure. The Air Force, in fact, the national government, is interested in developing a nuclear rocket, and in order to prove that the rocket works we need to test pieces of it on the ground, reactor on the ground. So that's basically the purpose of it.

3 2.1 MS. MACKLEY: In peace time why do we need a nuclear rocket? I just don't understand why the risk that we all are probably going to be taking, somewhat of a risk. We are not at war. There's nothing really threatening our country right now at the time. Why do we need weapons?

LT. COL. BLEEKER: Let me -- it's not that we are building a weapon. There are a number of things we put in space every single year, satellites for communication, satellites for surveillance. And what we are talking about is putting them in space. It's not necessarily a weapon in itself.

In addition to that, you probably heard of the possibility of using things like nuclear rockets to go to other plants, such as Mars. That particular case is something you almost can't do, with what you have now in

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technology.

4 3.2 MS. MACKLEY: Have you speculated, has there been any speculation of trying these tests, building your sites on uninhabited islands or other areas of the world where the population would not become so at risk?

LT. COL. BLEEKER: We screened a number of sites that were owned by the Department of Energy. None of them were on uninhabited islands.

MS. MACKLEY: Well, there's 118 of them off of the coast of Alaska. I just was wondering -- well, I am against your doing this so close to a populated area. I understand that the only time that these tests are made is when the wind is blowing towards this area.

I asked the Utah Radiation Department why this was so, and the answer they gave me was that we are furthest away from the site and that we are the least populated area, which is very difficult for me to believe.

We have grown and we are the fastest growing area in Utah today.

5 12.36 How soon do you start monitoring the milk after each test? Do you have the Health Department monitor the milk from southern Utah up in through Idaho? I know this was done before.

COL. HUEPEL: Well, I think this is something that the, what the procedures would be at that level, let me

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ask you, it's not something that's even set up, part of the determination right now, as to whether there is even going to be such a program.

MS. MACKLEY: All right. Thank you for your time.

COL. NUEPEL: Thank you, ma'am.

Margret Whitwood is next. And after Margaret Whitwood is Ihelia Brock. Is Margaret Whitwood here? Is Ihelia Brock here? Okay. And after Ms. Brock will be Seth Stinson.

MS. BROCK: I don't have specific fear of nuclear radiation. I do know that it is a dangerous thing they are playing with here. But, the pursuit of knowledge and man's infantiable (sic) curiosity seems to drive it forward.

6 2.1 But I agree with the previous speaker. There is not explanation enough to put why, to answer the question why. If we have a nuclear engine that can take us clear out to the furthest planet and back, what is accomplished besides an addition to the national debt?

I know that great scientific achievement denies humanity sometimes and inspires people. But we need more day down earth reality in dealing with the problems that confront the everyday concerns of the people who pay the taxes in this nation. Thank you.

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COL. NUEPEL: Thank you, ma'am.

Seth Stinson then Des Penny.

MR. STINSTON: My name is Seth Stinson. I'm a resident of St. George, Utah for the last seven years and a concerned citizen, a father of four children, and president of a local group here called Fix America First, with a membership of about 100 people.

I'd like to ask the panel, or the presenters this evening, if you have been using a lot of big words tonight and many of the people here are confused I'd like to know if you know what the word obfuscate means?

COL. NUEPEL: That's kind a rhetorical question.

MR. STINSON: Well, okay, I will define it for you, then. To render indistinct or dim, to darken, to confuse, or to becloud, as defined by the American Heritage dictionary of the English language.

7 1.18 I believe that this EIS has been written in such a way as to obscure many of the facts about the danger this project can create for the public, and it certainly minimizes for the testing program. This EIS must be completely rewritten in a way that will honestly deal with each issue of concern.

We will not buy the idea that it is harmless and totally under your control.

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8 13.6 Number two, the waste of taxpayers' dollars, why do we need this project? Are there not enough pressing issues on earth that could benefit from the proposed initial 800 million dollar expense. As a taxpayer I believe that this money could be returned to us to use in our daily lives instead of in this military or space application. We have earned our peace dividend and we need this money to feed our families.

8 13.7 Number three, any risk to human life is unacceptable. Although you assure us that we will not be harmed by this project, the past record has shown that the citizens of Utah have suffered and died from other so-called safe devices.

8 3.2 If this test must be done, locate this device on an island or on a ship where the fallout, if any, would land in water and not be a threat to human life.

Number four, can we learn from our past mistakes? Utahans have suffered from the effects of radioisotopes and many families are broken because of deaths and sickness caused by previous open air testing.

How can we allow this tragedy to happen again? We cannot. If we cannot learn from our mistakes we are destined to repeat the mistakes of the past. Open air testing is a mistake, and it may damage a new generation. Enough is enough.

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Accountability, number four. If this testing is, program, is as safe as you say it is, there should be no objection to providing me with all the names and work addresses and home addresses of all military, civilian and elected officials who are responsible for the safety of the public. If our local environmental radiation monitor should detect radiation from one of these tests, those responsible individuals can expect to explain their actions to a Grand Jury and face possible indictments. We will not tolerate any exposure to harmful radiation. Zero tolerance is expected. Thank you.

COL. NUEPEL: Thank you. After Mr. Penny will be Dennis McLean.

DR. PENNY: I'm Dr. Desmond Penny, and I teach physics at Southern Utah University in Cedar City. I spoke at this scoping meeting in March and subsequent to that I wrote a letter dated March 27th to Captain Scott Hartford. 9 1.2 Included in this letter, and I quote, I state, if this rocket is used routinely to lift payloads into orbit, the probability is that there will eventually be an accident during launch.

Given the tremendous explosive power of the boosters involved, such an accident would undoubtedly rupture the reactor and scatter the nuclear material in a very widespread fashion. It is only prudent, therefore, to

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assume a worst case scenario.

A toxicology analysis should be performed, assuming that all the nuclear material is widely disseminated into the environment, is breathed directly by people and is indirectly ingested by people consuming plants and animals that have absorbed the nuclear particles.

This analysis should include the capability of biological systems, including the human body, to concentrate materials in specific sites, thus maximizing their biological and genetic affects.

1.2

I do not find, on reading your EIS, I do not find the scenario addressed in your EIS. The reason is that your EIS restricts its scope to only the testing phase. I hope to show that this is a very artificial restriction.

The closest your EIS comes to considering this scenario is the Consequences I accident scenario, which is defined as, quote, the accident assumes the total release of all radioactive material. The core is assumed to be released in a completely aerosolized fashion, unquote.

In your EIS this scenario is dismissed by saying that, quote each of these assumptions represents an overly-concerned bound which cannot be realized physically.

I would put it to you that in actual operation of the rocket, this scenario is possible. In fact, if you put this reactor atop a primary booster of tremendous

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explosive power and use this rocket frequently over an extended period, a Consequences I type accident becomes probable.

Later in your EIS you do give a cursory examination of a Consequences I type accident, and even though it is for an explosion at ground level instead five miles in the air and in an extremely low population area with favorable wind conditions, the results are frightening.

1.2

And I quote from your own EIS, a Consequences I type accident would contaminate an area of 10 square kilometers for 34 years. It would contaminate an area of 10,000 square kilometers for 126 days. Here contaminated means a dose rate exceeding 100 millirems per year.

The doses resulting from a Consequences I type accident would be up to 880 millirems at a distance of 120 kilometers. This is a very large dose which exceeds the ANSI standard of 500 millirems. Your own EIS admits that this type of accident would emit very large radiation for a distance of 120 kilometers. For those listening, to get a feel for that, this would expose everyone in a 120 kilometer radius to a radiation dose equivalent to 280 chest x-rays.

Clearly, the results of a Consequences I type accident five miles in the air over an area with a significant population would be catastrophic.

In conclusion, I believe there is great promise

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for the PBR technology in a stable reactor situated in a strong containment facility far from earthquake fault zones to be operated in well understood stable environments. The proposed use would place the reactor atop a primary booster of huge explosive power in a highly stressful operating environment. History tells us that this is an accident waiting to happen, an accident that would disperse the nuclear material in a widespread fashion.

1.2

This accident would have much more serious results than your own Consequences I type accident, which by your own analysis would be truly frightening. I believe this technology should be investigated further, but to consider placing the reactor atop a primary booster rocket is insane. I believe you have artificially restricted the scope of your EIS such that a Consequences I type accident can be considered unlikely.

Since this type accident becomes probable during the working lifetime of the rocket, a reasonable extension of your own analysis shows that the proposed final use is crazy. The program should therefore be halted immediately without further expenditure of taxpayer funds and redirected towards a more sane final goal. Thank you very much.

COL. HUEPEL: Thank you. After Mr. McLean will be Julie McKown.

MR. McLEAN: Thank you. I agree with everything

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he said. Didn't understand him, but I agree with him. I'm here as an American citizen. Are any of you gentlemen a nuclear physicist, biochemist or anything like that? So what you have got, to me, is hearsay. See, I can only speak -- I don't know that much about this. I can hearsay about Vietnam for two years, when a group of light colonels and colonels told me Agent Orange would never hurt me. Well, my children now have their reward.

What I am tired of is the government always oopsing us. My secretary has a daughter from thirty-three years ago when you oopsed her. She has an I.Q. of about a three-year-old. I have a lot of children and everything. I just want to know why you guys keep doing this to us, when it's proven fact that every time the government does something experimental, especially with the military, it always backfires. I mean always.

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12.81

What I want to know is not what's going to happen to me today. You know, I have read the reports you guys got here in this town and all this. What's going to happen to me and my children 10, 20, 30 years from now? You know, that's when it usually hits us. And, you know, everybody I talked to says, man, it's going to be crazy. Why don't you put this to a vote of the people instead of you of you committees making it for us? Give it back to the American people. We're the ones affected up here in

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D 13.4 southern Utah.

I just want it on the record. I am against this. It's our lives. Let us vote on it, and I will guarantee that my vote is going to be no.

COL. HUEPEL: Thank you. After Ms. McKown will be Orson -- either Orson or Eve Scott.

11 1.8 MS. McKOWN: I'm from Springdale, Utah, up where we had a little slight shake-up the other day. And one of the things that I'd like to address right away is lack of notification. We happened to hear about this the first time in our town last night at the open house for school, which came around on a little piece of paper from the school district asking us to attend this meeting.

There were no posters put up in town. We have no radio, we have no local television. I'm a little bit upset that there was, that only that for notification. A small article in the Spectrum. It's kind of hard when you are in an outlying information to get that kind information about something that is so critical.

I'd like to say tonight, it's the eighth anniversary of the death of my best friend. The USU pathology lab diagnosed a textbook case of radiation induced thyroid cancer. I'm here in her memory on this anniversary.

You mentioned earlier that this is a hearing on

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the environment. Are not human beings part of the environment? As if we were only to speak on environmental issues.

And certainly, their genocide should be considered in your EIS. Trust has been lost in our community, and it was lost a long time ago. I didn't live here then, but I saw someone very dear to me suffer greatly, and it's the anniversary of her death tonight. It's just kind of uncanny that I should be standing here on her anniversary. Trust has been lost in the community with similar projects and for me to say to go on with another one would be asking for genocide, in my opinion. All I can say is never again, never, ever, again.

COL. HUEPEL: Thank you, ma'am. Mr. Scott, and after Mr. Scott will be, I believe it's Penn Smith. Yes, sir.

MR. SCOTT: My name is Orson Scott. I'm from 12 2.1 St. George, Utah. I'm a concerned citizen. My question is to the panel, being as how this seems to have a great risk to it, is it essential for national defense?

LT. COL. BAUMGARTEL: We can't answer that. This is not a panel set up for the experts to explain tonight how the government makes decisions. Only the elected officials make the decisions. We are here to take your comments, if you are concerned about that.

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MR. SCOTT: You are not here to answer questions?

LT. COL. BAUMGARTEL: The procedures and whatnot that we used in the EIS, or questions about the proposed action, that's about it. We didn't bring all the folks that work on it.

COL. HUEPEL: Just a minute. Just a minute. The issue is clarifying questions about the EIS itself to the extent that possible the panel will try to answer. But as far as questions about is it cost effective, is it essential for national defense, those are some of the basic questions that will have to be decided about whether to even approve this. This is not something that this panel can decide.

That's what each person here in this room is going to have to decide, and the actual decision makers are going to ultimately have to decide, and beyond them, Congress. So this panel can't answer that.

MR. SCOTT: Can't answer that? Okay. All right. Okay. Thank you.

COL. HUEPEL: Thank you, sir. Is Ken Smith here?

MR. SCOTT: He left.

COL. HUEPEL: He left? Okay. Colin Harrison, or Collin Harrison, and then Sandy Ferrell after

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Mr. Harrison.

MR. HARRISON: My name is Colin Harrison. My wife and I live 140 miles away from Saddle Mountain test facility. I'm here as a concerned citizen.

Prior to my making my comments, the Draft EIS, I wish to state my credentials for making those comments.

I've got 35 years experience in aerospace. I started in rocket engine design. I was the chief test conductor for Titan I. I was the chief of Titan Stand Board. I was director Gemini Manned Space Craft Center, the Gemini program at the Manned Space Craft Center, Cormite Company, up to Nasa. I was Director of Advanced Manned Space Craft Design, I was the program test manager of the most expensive and the then year dollars of the nonclassified space craft that was ever launched. I was the verification chief for the external tank for the Shuttle. I ran the Tiger Team for the cryogenics systems in Slick Six, the west coast launch site for the Shuttle. I was the operations director subsequently to that, and Slick Six and then became director of Slick Six. After the Challenger I became director for International Space Parts, and prior to you my retirement I was chairman of the Flight Readiness Review Board.

In summary, I've got a lot of experience with cryogenics, rocket engines, test facilities, and test

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locations. Originally I had about sixty comments, but I figured I'd have about five minutes to speak so I have narrowed it down to about five view-graphs. But I tried to condense my concerns to the EIS in it. I guess a condensation of the important comments I have is that the program appears to have no definitive limits.

13 2.1 What's going to be developed. There are no program objectives explicitly stated. Mission applicability is grossly exaggerated. Radiation impacts appear to be intentionally minimized, or as we heard the word, clouded. There seems to be an absence of rocket test technology throughout the test program. There seems to be a reliance on static nuclear power generation technology, and there's an absence of the classic verification, validation disciplines.

I've got five view-graphs. Each bullet will start with a quotation from the EIS then cite the applicable EIS chapter and followed by my comments, and I solicit any questions or comments you might have during my presentation. First bullet proposes, the quotation is, proposes to conduct validation testing of PBR technology. That's from the cover sheet. And my comment is, what's the 14 2.2 specific charter of the Air Force? Is it Leo Missions? And certainly based on my experience I had with toxic propellants and nuclear reactors down at the Cape. I know

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14 cont'd 2.2 you are not going to be able to ever get an okay out of those people down there to fly a Leo Mission.

15 2.2 You've got to develop turbomachinery. It's not stated there. I saw tonight in your view-graph that you talked about the turbopump, but is that included? Are flight tanks included? How about the flight moderator? You going to have a battleship moderator on this thing? I don't seek answers for those now, but I'd like to see it in the next EIS.

I also appear as an endangered specie, the E 13.8 American taxpayer. So I'm concerned about the scope of this program. Is it one billion dollars? Is it 10 billion, or is it 50?

16 12.8 Second bullet, no impact exceeds applicable *limits has been identified* at either location. I think it's clouded, and the words you use is a credible explosion or a credible catastrophe or a credible case. My comment is, there's no identification of impacts larger than the total PIPET failure is really covered. 17 12.9 Case of complete failure of two gigawatt engines is omitted. What will prevent the critical mass detonation and how will techniques be validated?

18 12.11 There's nothing about taking one of your fuel pellets or 50,000 of your fuel pellets and heating them to 5,000 degrees Fahrenheit and shooting them into a steel

Document 2

18 cont'd 12.11 plate at 5,000 feet per second. Those are all environments that you are going to encounter in this engine. Could we have the next one, please, Scott?

COL. HUEPEL: We are at the time.

I'm sorry, but the time limit is five minutes, and we don't have a thing of where somebody can give up time. However, do I presume that you will either send something in, or can we have your view-graphs so they are all appended to the record?

MR. HARRISON: There's copies of them. I will tell you what, I will make a promise for you. If I don't see answers to my questions in your EIS, I will go to Washington and appear before Congress.

COL. HUEPEL: I believe this is Sandy Ferrell, then Mary Ann Probert.

MS. FERRELL: I have, first of all, a suggestion. I'm here as a St. George person who lives in St. George, a concerned citizen, a mom and a school teacher. I realize you are dealing with a highly technical subject. I have invited some of my students to come here 19 1.18 and I have a suggestion, that you look at the language and some of the explanations and see if there's a way to make those more understandable in layman's terms.

I have some questions in some of the terminology that have come to my mind. You used the phrase the

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uncertainty of the composition, and that is a phrase in my mind that makes me question some of the things that are happening.

20 12.7 I'm also concerned about the length of time for the testing. I believe you mentioned 5 to 10 years, and that may have been just on one phase of the testing. And I am concerned about the accumulation effect, both on humans and the plant and animal population.

I have only lived in St. George for six years But you don't have to live here very long to hear about a student who lost an uncle or a friend who lost a mom. I believe that the people of St. George have paid quite a 21 2.1 price for some of the testing that has occurred. I believe, in my mind at least, the purpose of this testing has not been adequately explained in me to justify the price, and I don't believe the people of St. George are willing to pay that price again.

COL. HUEPEL: Thank you. How do you pronounce your name?

MS. PROBERT: Probert. Mary Ann Probert.

COL. HUEPEL: Okay. And after Mrs. Probert will be Doran Fox.

MS. PROBERT: I have no speech prepared, gentlemen. I'm just here as a concerned citizen, as a parent and as an American. It is difficult enough in these

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times to survive the economic environment and other things that we contend with on a daily basis without having to struggle to survive an attack like we are facing in this situation.

I think it's apparent tonight that the majority of the people here do not trust your explanation. We do not
F 13.4
want to be. we do not want to be killed. We do not want this. And I'm just here to voice my disapproval of this publicity. I do not think that this is safe and my vote is no.

COL. HUEPEL: Thank you. Is Doran Fox here?

Apparently not. Arthur LaBass. I may be off on that. And then Jacob Stevens.

MR. LaBASS: I'm just a concerned citizen. I just don't trust the government anymore at all. I don't think they have the best interest for the people. I don't know whose interest they really do have in mind. but they sure don't have the people.

28 3.2
And myself. I don't see why they couldn't have put in a location. if they were going to do it. or are going to do it. out on an island or somewhere where no population at all is at. To me. why do they want to hurt people?
6 13.4
Because that's what we are going to do. And my vote is against it. too.

COL. HUEPEL: Thank you. sir. After Mr. Stevens

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will be Linda Copeland.

MR. STEVENS: It's kind of hard to speak tonight. after the people who have been so qualified have already spoken. Yet I guess we should all stand up and be counted. I guess just a brief analogy I was thinking on the way over here. how. you know. if a bee stings one person. there may be no reaction. if a bee stings another person. he may die from it.

And I think it's pretty hard to tell how this is going to affect our citizens. If we say it's not going to hurt anybody. you can all can visit the cemeteries in St. George and tell the people that. This is what they were told before.

I think you all know that you have lost your credibility a long time ago.

COL. HUEPEL: Thank you.

MS. COPELAND: Gentlemen. I am not a chemist or a physicist or a biologist. I am not even a rocket scientist. I'm a concerned citizen of St. George. I have lived here a total of five years. I'm a mother of three.

You mentioned that there are some of our questions that you can't answer. Is there any way you can get somewhere here who can? I don't know if you guys are scapegoats or just how this comes down or if we have to flood our Congressmen with letters or what. but the people

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in this town have a right to be heard and have a right to decide our fate. if we are going to live or if we are going to die.

And I have to wonder about the Environmentalist Protection Agency. if these were tortoises or snails what their. what their decision would be. Thank you.

COL. HUEPEL: Next will be Rebecca Hurst. followed by Phil Foss. Yes. ma'am.

MS. HURST: I think it's important for you to be involved. And you are saying it's going to be 5 to 10
29 12.61
years. And I just want to know if this will affect my children and their future and my future. And my uncle died from nuclear testing. and my aunt got very sick. I just want to know if. is this really safe? They said to him that it was safe. But I am scared. I just -- is it safe?

COL. HUEPEL: I think the best thing. that probably can be said is what has already been presented with regard to the radiation.

AN UNIDENTIFIED MAN: Not good enough.

(Other unidentified and unintelligible comments were made.)

AN UNIDENTIFIED WOMAN: Can your kids get it?

COL. HUEPEL: Essentially. I think the presentation. to sum up the presentation --

Okay. that's fair enough. Let me just ask from

Document 2

a lay standpoint if you can.

LT. COL. BAUMGARTEL: If I may. let me make a qualifying statement. The decision is not being made at this point. What we find from the scenarios we went through. the operational normal testing or an accident scenario. that the levels of radiation are down in the very small numbers that we showed from 23 millirems. one annual dose. even smaller than that on the operational side. compared to a background radiation that you have right now. every year you get about four 425. 450 millirems per year just because you live in the world. depending on the location. how far up in the mountains you are. et cetera. how much uranium is in the soil.

But that exists. you know. radiation exists. we are just putting that in comparison to it. We are talking very. very small numbers.

So there's all kinds of study on health risk of radiation. and there's varying opinions. all through the report. setting normal limits. there's one set by the national health folks and EPA. whatnot. what they consider safe for workers on the site and what and they are a lot higher than that. that background radiation.

So you have to draw your own conclusion on what you are basing your facts on. on what health effects you have so down received one millirem or two or 23 millirems

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per year and whether or not that's, what is attributed to health effects?

So we are putting out the information to the decision makers and they will have to look at that. That's downstream. We are getting comments on the document and we'll publish the final.

But there is no decision, before it comes out final in January, and then it's a 30-day waiting period for comments again, review by the EPA and has to be offered to the public. So there's no decision between now and then, these are just facts, factors that we --

COL. BUEPEL: Let me ask this question. Based upon all of the millirems, because I don't understand most of that any better than you probably do, but based upon what the standards are and what the expectations are, is that in the level that you would generally consider safe? When I say you, whether it be environmental engineers or the general public would consider -- maybe I shouldn't say general public, maybe I ought to say experts would consider safe?

LT. COL. BAUMGARTEL: If it was my personal opinion I would consider it safe. From the reports I've read on the health problems from radiation from that level, I say it's in the -- you could take variations. We are in the variation that would be, whether you live in a certain

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part of the United States, it would vary 25 millirems a year or whether you are up in the mountains or whether you are flying airplanes or whatever, or how many chest x-rays you have. If you have normal chest x-rays and dental x-rays, you get 90 to 100 millirems per year.

COL. BUEPEL: Does that --

LT. COL. BAUMGARTEL: I consider it safe.

MS. HURST: So you could live with that? I mean, you feel safe?

LT. COL. BAUMGARTEL: Sure. Sure.

AN UNIDENTIFIED WOMAN: Then you can move here.

COL. BUEPEL: Thank you. And after Mr. Fons, is that the way you pronounce it, sir?

MR. FONS: Yes.

COL. BUEPEL: Will be Angela Frabasilio.

MR. FONS: Can you hear me okay in the back? Okay. I come to this meeting as a concerned citizen, because my wife has been fighting the battle with cancer for the past 18 months, and probably 8 or 10 of my friends have all died with cancer, even with the Regional Cancer Center and all the good things you can do for it.

So I think a number of the people here that come to the meeting with objections and so forth, we hate to lose family, we hate to lose loved ones and so forth. And sometimes we can't help but wonder if it's unnecessary.

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My name is Phil Fons, and I have been a resident of St. George for 16 years. Over 25 years ago I worked for the Aerophysics Propulsion Field Laboratory at Santa Susana. This was a Rocketdyne Division of Rockwell International near Chatsworth, California.

I worked on all the early rocket testing that was done over a 20-year period. And in my work as a senior research engineer supervisor, in this R&D section we were called on to put together a proposal for what was then called the NERVA nuclear upper atmosphere rocket engine system, and with this it was to be tested there at Jackass Flats, Nevada test facility. So we did a lot of work on it, as did many other potential contractors.

In order to prepare for this engine system cost proposal, we were required to have the Air Force top security clearance, plus the Q clearance, and other clearances and demonstrate a valid need to know.

Now, the thing that is confusing to me, and it's been brought up by others, if we are in a peace time economy, we are closing military bases and we are toning down defense spending, why would we have this as a super secret project? Why is it classified? I'd like somebody to answer that. And I'd like to have that answered in the EIS when it comes out in it's final form.

LT. COL. BAUMGARTEL: I can answer that now.

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It's not a classified program.

MR. FONS: Well, that doesn't tell us anything.

LT. COL. BAUMGARTEL: The program is what you see in the EIS.

MR. FONS: If you don't need it for defense, we don't have any aggressor, we don't have Communism, we don't have anything else, obviously, we don't have an aggressor, we don't need the program.

COL. BUEPEL: Well, there's a difference here. The question you asked, why was it classified, and he was providing an answer to that, that it's not classified. What you are going into now gets into debate which we can't get into.

24 MR. FONS: Well, I'd like to see that particular answer given in enough detail so people could sort out in there own minds if there is a reason and need for it to be classified or if it is needed for national defense. I think
2.1.2.2 then it ought to be stated in some way so that those involved could weigh that. If it's something that keeps our country safe, are we willing to consider the risks or potential risks involved? And that's one of the things I think that would enter the minds of some of the local residents.

If it's something in that area, it would be one thing, but if it's nice to know and if it's for deep space

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24 cont'd 2.1.2.2 probes for visiting the planets and so forth. I think that they should indicate, too, on the EIS, what would happen if we don't get this project? What would be the end of the world? What would take place if we didn't get it? How would we be impacted, and how would we be disadvantaged as a nation? I think those things would be relevant, to mention those.

25 3.12 Of general interest to some of the St. George residents would also be, the number of engine systems to be tested. You went into it in some degree. But as far as how many combinations of hardware will be tested and the number of anticipated runs per year, per month or per year, run duration, thrust level, all those things, you talk about a 10-year period. That's an awful long time to consider being, to have an exposure.

The question I'd ask, also, would it be mandatory or could it make it mandatory that the people running the tests move their families here to St. George so they can enjoy the same environment that we have? Therefore, if we are going to get radiation, let's everybody share it.

26 12.13 The other thing is, the other thing is by comparison to a conventional underground nuclear test. I think it would be interesting to know from the testing that we have had in the past, many tests in the last many years,

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26 12.13 what level of radiation is expected? You gave numbers. But how does that compare with the amount of exposure that we have measured at the various stations, particularly within this region? I think people would be interested in knowing that as one of their ways to make a decision.

27 3.4 And also, what's the time frame for starting the HD testing? Is it in 1993 to be completed in the year 2003?

28 2.2 And we'd like to know what's required in number of tests and duration for flight rating tests after you get hardware development.

Okay. One last thing, and I will finish. If there is a strenuous objection to nuclear testing at the

29 3.2 Nevada test facility, have we considered negotiations with the Russians, whose nuclear test facilities are now virtually inactive? They have nuclear scientists and advanced technology personnel available to conduct nuclear tests and would no doubt welcome the opportunity to use their facilities and personnel. Thank you, gentlemen.

COL. HUEPEL: Thank you.

Is Angela Frabasilio here? Okay. Sorry if I mispronounced that.

MS. FRABASILIO: Hi. I've had all my questions answered. I'd just like to address that man that just left. I have been to the Soviet Union and seen the people there. You don't want to see them. I can't explain anymore.

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COL. HUEPEL: Thank you.

Let's go ahead and take a 10-minute break. I have about 18 cards left.

(Whereupon, a recess was had.)

COL. HUEPEL: Nerene Mackley will be first. Is Rhonda Chertkow here? Okay. Lee Daniels?

MS. DANIELS: I have already given my speech.

COL. HUEPEL: Okay. I have mixed up a couple of these cards. Let's see, Margret Whitwood. Did we call on you? To be followed by Val Cram. Yes, ma'am.

MS. MACKLEY: I started home a few minutes ago and something grabbed me and said no, you go back. And I know this is going to be sort of an emotional appeal. I am a lifetime resident of Washington County. I come from Ivins, Utah. I have seen numerous people die from cancer, including my mother. Ten years ago she died from multiple myeloma which is bone cancer in numerous parts of her body. She's never smoked a cigarette in her life, never drank any form of alcoholic beverages.

My parents were farmers. The doctors told them that there's no question that she died because of the radiation in our area.

I remember as a child, being out in the garden in Ivins, when a military man in a uniform said, my (unintelligible) was green, but he came by, and he said go

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inside, have a bath and wash your hair. And I looked at my mother and I thought, that's a very strange thing for someone to ask you to do. And I said why? She said because there's something coming out of the sky. And I remember looking up and thinking, there's nothing there.

I think we were appeased for so many years. And about a year ago I checked out a couple of books from the library, and I think one of then was called Countdown Zero". I have never been so angry in my life as when I read that book and realized the cover up, the shortchanging of people in this county, and the needless death of my mother.

And I'm sorry I'm so emotional, but it makes me so angry. No one has a right to take human life that way. No one has a right to take away from my children their grandmother, and yes, we have suffered in many ways. But it's mostly emotional, financial. My father's waiting for his $50,000 check. What a small payment for the pain. And the emptiness. You can never repay that.

I have the opportunity to now, for 20 years, to collect the same amount, should I come down with it. I hope to high heaven my family never has to collect on it.

These are thoughts that have been running through my mind for a lot of years. And I just felt like in my mother's memory I had to stand up and be counted and say enough is enough. Take it somewhere else, if it's needed at

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all.

30 And I have to voice my opinion, also, at a time
2.1 when economic concerns are so great, why is it so necessary? Why is it so necessary? It might be wonderful reading in the National Geographic, or something, like they show you all these trips to outer space, and I agree that technology can be a wonderful thing. But at what expense?

H I think there comes a time when there has to be to limit to the things that we do just because of joy or
18.6 intrigue or even continued education. There's too many things down here on earth we need to grapple with, life and death situations. And I just hope and pray that somebody will have enough sense to put a stop to the things that cause so much pain. And I say this in -- that's all I have to say.

COL. HUEPEL: Thank you, ma'am. After Mr. Cram will be Donald Henderson. Mr. Cram.

MR. CRAM: My name is Val Cram. I'm a resident of St. George Utah, and born and raised in the southern part of the state, lived here most of my life.

I would like to ask the panel if the national media was invited to this meeting?

COL. HUEPEL: I think I can tell you that the hearing has been published for 45 days. I believe that's the requirement. Is it 45?

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LT. COL. BAUMGARTEL: No, it's in a 45-day period. I am not sure of the date we announced it. We do so many of these. Scott, can you help me out?

CAPT. HARTFORD: It's about 15 days.

COL. HUEPEL: 15 days?

It's a 45-day public comment period, and the listing of all of the hearing sites and the dates and times has been placed in the Draft Environmental Impact Statement which was sent out to people that had indicated, both at the scoping process, that they wanted copies, to libraries, to state and federal officials.

MR. CRAM: I don't see Channel 5 News or anyone there that could broadcast this at large. Maybe I am wrong. Maybe there's some national news here that I am not aware of, or maybe local media. Were they invited? I don't see a camera. I think these are probably government cameras that are zooming in on me now.

COL. HUEPEL: All I can tell you is, I heard the announcements on the radio this morning. So it has been out. Certainly, I understand, though, the lady's concern about where she was some distance away. But it's certainly been out within St. George and has been publicized in some of the media. So we are not in a position to answer why the television media isn't here tonight. We had television media in Las Vegas, and they reported it, both the written

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media.

MR. CRAM: Is it standard procedure to issue a press release --

COL. HUEPEL: Yes.

MR. CRAM: -- of these proceedings? How can we as residents obtain a copy of the Environmental Impact Statement?

COL. HUEPEL: If you want either the draft or a copy of the final Environmental Impact Statement, if you will just indicate either on one of the information sheets or on one of these sheets, put down your name and address and put on there that you want it. They will get a copy to you.

MR. CRAM: What is the cost for that?

LT. COL. BAUMGARTEL: Nothing.

COL. HUEPEL: There is no cost to you personally.

AN UNIDENTIFIED WOMAN: We paid for that already.

MR. CRAM: I am a member of that diminishing specie myself. I have lost faith in my government officials and I'm very disappointed that they continue to press to test in our area. It's so saturated with the contaminants that blew over and, from the bodies of our own dead. We wish, I wish that testing could be moved to the waters of

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the Potomac River along Washington, D. C. somewhere where it could really be appreciated.

COL. HUEPEL: Thank you. After Mr. Henderson will be Chuck Schenck.

MR. HENDERSON: I am Donald Henderson. I live in St. George. I'm a retired meteorologist. I worked on the previous space nuclear propulsion project 25 years ago when it was referred to as the NERVA project. I had responsibility for calculating radionuclide concentrations downwind from those tests.

My main concern has to do with the radionuclides that might reach this area as a result of the tests. It's difficult for me to believe that a test, or tests, you'd be conducting on such a project would have so little impact as you indicated, based on the previous work that I did.

I have several questions, and you probably won't answer them now, but they should be answered in the Environmental Impact Statement. I have not read the Draft Environmental Impact Statement, and some of these questions might be answered in that Draft EIS.

My first questions will be concerning the amount of radioactive material that is released from these tests. And the question that you might answer now, though, is the hydrogen liquid or gas that's used?

LT. COL. BAUMGARTEL: It's a liquid going in and

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gas coming out.

MR. HENDERSON: Then it goes through the system as a gas? Okay.

31 12.11 The uranium beads are covered with zirconium carbide. Has anyone done any tests to determine if the integrity of those beads holds up under the extreme temperatures?

LT. COL. BLEEKER: Yeah. I can answer that. There's been significant testing. There are several layers in addition to the zirconium carbide. We have tested them, even inside a nuclear reactor. But not under the powers we are talking about now. but certainly under those temperature. so we know they stand up.

MR. HENDERSON: Okay. my next question has to do with the treatment of the effluent as it comes out of the

32 1.13 test nozzle. I'm wondering what system is used to scrub out the radionuclides. Is it a scrubber? Is it an electrostatic precipitator? Is it a bag house? Or what kind of system? Just filters?

LT. COL. BLEEKER: There are several methods contemplated. The one we're looking at is to bring it down to cryogenic temperatures. basically entrapment. Particularly the noble gas.

MR. HENDERSON: Okay.

COL. BLEEKER: There are several designs they've got for scrubbers and they tend to be conventional scrubber

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designs. Particularly difficult. to get rid of the radionuclides that the noble gasses emit we have to bring them back down to cryogenic temperatures to scrub them out.

MR. HENDERSON: The gas is frozen?

LT. COL. BLEEKER: We are going to freeze it.

MR. HENDERSON: The gasses will escape into the atmosphere?

LT. COL. BLEEKER: No. The only gas that we put out in the atmosphere is hydrogen. It's totally scrubbed, if you want to call it that. before it's flared. burned out of a stack.

MR. HENDERSON: I don't believe there is such a thing. You might get 99.9 percent or something.

LT. COL. BLEEKER: That's what we're claiming -- 99 percent.

MR. HENDERSON: My next question. once you get

33 12.14 the source term or the amount of radionuclides of remission. or that are remitted. then what techniques are used to make calculations downwind of concentrations that the public might be exposed to?

You have given some results that would show that you have used the most extreme conditions to give the worst case concentrations. No information was given on what techniques were used. I'd like to know what was used. But you don't need to elaborate on that now.

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33 cont'd 12.14 Also, once the radionuclides are exposed or reach an individual. what techniques are used to calculate the exposure that that individual would have to cause lesions or whatever from the radioactive material?

34 1.18 Okay. Then I'm wondering what you have done to examine the tests that were conducted 25 years ago. Are you relating what you have done here to what was done then? Can you use that information to help you in determining what effects or what impacts these tests are going to have downwind?

35 2.1 Now, many people have asked this question. One more question. What are the consequences, if the Air Force does not continue on with the development of the PBR? This has been asked over and over and over, and there have been no answers given.

Well. I question the need for this project, and I oppose it.

COL. HUEPEL: Thank you, sir.

Is Mr. Chuck Schenck here? Okay. Ava Stevens? Ava Stevens is not here. Priscilla Empey?

MS. EMPEY: This is a map. I'm Priscilla Empey. I'm the Utah State Representative for the National Association of Radiation Survivors in Utah. I'm also a concerned citizen. a person who has lost nine of eleven immediate family members and ten family members. say that

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tests that were done before. My father was a uranium miner. my uncle. both died. And the 1950s. the Dirty Harry's or the ranger said. the series that on is the one that has affected our area the most. and has done the most damage.

36 12.37 And when you say low level radiation is minimal or you don't have concern for low level radiation. it's the one that's the most deadly. It's the one that's going to creep up 10. 15. 20. 25 years later in our children and our grandchildren and the generations to come.

If you drop the bomb. like you did on Hiroshima and Nagasaki. it's over and done with. But. if you are suffering are the ones who have had the low level radiation fallout.

This graph right here that I have in my hand shows from the Nevada Test Site. the highest radiation exposure area. which is including Bunkerville. St. George. and there. and in the downwind fallout path. with the prevailing wind direction takes it almost to the border and on in. out of our state. So you can't say that it's safe.

The government. we just lost all faith in the government. As far as I'm concerned if I heard. I heard other people suggest it's just another dog and pony show. We want to get on with the real facts and the real things that are going to be of concern for us here in this area.

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When Dirty Harry ran off and the contamination came, the radon, the tests, showed that there were dangers for us in this area. But the people who were monitoring the system were told that they were not notified, not to talk to us. They said there would be evacuations if there were dangers or something, but we know that isn't so when it comes to southern Utah and the families in the area, that we're expendable to the government.

So we want you to know we're not expendable. We're human beings and we have a right to this life, and to lives of our children. And I want to say that 1 percent is one too many. If it's 99.9 percent is safe, that 1 percent is not safe and that 1 percent is the one that always comes to harm us, and we don't want it, we don't need it.

37
2.1
And I also question the need, for my folks, I want that on record. Thank you.

COL. HUEPEL: Thank you. Rick Caten, to be followed by Angus Snow. Is Rick Caten here? Angus Snow? Okay.

MR. CATEN: I'm a concerned citizen of St. George. In summary, what's been said, this has been said many times, but this isn't for national defense, it's to protect us where it comes into the realm of a luxury for a toy, something that's nice to have. And you know, VCR is nice to have, the satellite dish is nice to have, but if it

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comes to a point where that's going to harm somebody, or a life, then the life comes first.

When we look at this whole situation, it comes to, if it's nice to have, it's great, it's going to help us, and it's extra. But this is something that the Air Force saw that could help them that could be good. If it's good enough that it's going to help us in the future, there are unpopulated places like has been mentioned before, there are places that nobody's going to be hurt, because it's going to happen. The bottom line is, if the Air Force wants to play ball, let them play ball where they're not going to break any windows.

COL. HUEPEL: Thank you. After Mr. Snow will be Owl Woman.

MR. SNOW: I'm Angus Snow, also a resident of the Shoshone Reservation. I also represent the downwind faction of the National Association of Radiation Survivors. You mentioned to us that they are only to address environmental considerations.

We have covered all of the natural resources and the cultural, the social. We have heard people talk about our work environment. And about the wildlife and about the water. I think I'd like to dwell on the cultural aspect.

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9.1
Who gives the right of the National Registry to decide what is of historical value to my people or anybody

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38 cont'd
9.1
else's things? And what I think is quite damaging, I don't think a lot of people know, that the military and the DOE, this impact statement is all done by government officials, government entities. Who pays them? They are all scratching the judge's back or picking bugs out of each others hair. I don't know what.

But I think the impact on the social impact around this world as far as anything to do with nuclear, is that around the world of nuclear activity or nuclear tests have been tested on other people's land.

Here in the United States, the biggest, worst abomination in the world, is the nation of the Western Shoshone, where the Nevada Test Site sits.

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Now, saying that, I often wonder, too, with the comment I heard tonight considering, why don't we move this though the Soviet Union or someplace?

AN UNIDENTIFIED MAN: Washington, D.C.

MR. SNOW: I'm talking about the Soviet Union. Do you know the funny thing is, we are talking about saving people's lives and the cost of a human life. You know, I think some of the people in this audience should realize that people, we have the same color, people have the same emotions, whether this is in Russia, Japan, even the United States on the Western Shoshone land. And if you are going to advocate peace and fight for peace, then you should live

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have already been done.

And as far as sending things out in space, the rocket, the real name was Timberwind. I say it still is Timberwind. It's under another name.

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1.20
But I asked the Air Force, what is the Air Force monkeying around with space for? What happened to NASA? What is the thing with the DOE, the Department of Energy? What is the Department of Energy doing monkeying with bombs? I think the government is, should get together and decide their priorities and make human life their number one priority. Thank you.

COL. HUEPEL: Is Owl Woman here? Okay, apparently not. Catherine Ford. To be followed by K. R. Whitwood.

MS. FORD: I'm sorry for the feedback. My name is Catherine Ford. You have heard a lot of people say that their relatives died. I'm a downwinder. I survived 15 years of cancer, of thyroid cancer, which is a result of low level exposure to radiation. I never know when or how my body is going to attack me next. I never know what effect it will have on my family.

My mother has had a 20-year guilt for having me in southern Utah and for not moving somewhere else. But who knew, when we were told to go see the bomb and the mushroom cloud?

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peace, instead of just preaching it. That's for the audience here.

But as far as credibility goes, your bed partner is DOE. And their track record is atrocious. The funny thing is, everything, you don't want to tell us, the important stuff is always classified.

There have been people protesting for years. Are they also going to protest down the DOE? Why? They are not going to listen. They are not going to hear.

I think there's another thing, that the government is why they send you here. The people had nothing to deal with, not with the decision makers. You know, where are they hiding, and why are they hiding? Why do they send you? If it's so important to them, why are they not here discussing their plans?

You were saying about your uranium transportation, there's no impact. I think it's another crock. I think you should go and ask the uranium miners what kind of impact they have had working with uranium. And your hazardous waste transportation. I say any amount is too much.

Now, my organization works with people that are suffering, atomic veterans, atomic widows, downwinders and so forth. The list goes on and on. The things that we are concerned about is working in the aftermath. The problems

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I'm sorry, this is hard. The environmental impact and the physical and the psychological and the financial impact on my life and on the life of my family and my friends has been devastating.

I am a teacher here. I spend my life working with over 250 children a day. I teach over 500 children a year. I don't want a new generation to have to go through what I have gone through. I don't want them to feel like guinea pigs. I don't want them to have to feel the distrust of this government and of this country and of its policies.

I am a firm believer in education and in research and in development. But I can see no justification for this kind of policy. I don't want it put out on a desert island or an uninhabited island. I don't want a whale to have to go through what I did, or a snail or a cedar tree.

Surely, we have had enough nuclear disasters or close disasters, everything from Three Mile to Chernobyl should be enough.

I have been bombed by my own government. Please don't let it happen to another generation. Anything is too much and it only takes one second to have a hellatious disaster. I don't know if this will do any good. I don't know if this will have any impact, and I'm sorry if I am not addressing the impact on a tortoise or a tree or a burial

Document 2

site, but the impact on my life, my environment, my future and what's happened to my family has been devastating. I don't trust you. I am not speaking of you personally. I am speaking of you as a cumulative body.

You aren't here. You don't have to watch what happened 15, 20, 30 or 40 years later. You don't have to see what happens to the families and what happens to the people.

My life has been radically changed by your low
1 level exposure to radiation and, frankly, I think any is too
18.4 much. Please, don't do it to us again. Don't do it to the children again, and for God's sake, just stop it.

COL. HUEPEL: Is K. R. Whitwood here? Apparently not.

Claudia Peterson? To be followed by Orson Scott.

MS. PETERSON: My name is Claudia Peterson. I spoke to you gentleman before, I believe. I'm encouraged to see there's more people tonight. But as things drag on, people leave.

I am really disheartened, too, that the people that make the decisions aren't here. Where are they? Why aren't our Congressmen and our Senators here? Why -- the people that are making these decisions, do they detach themselves enough from us that if it's on paper they don't

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have to know, they don't have to see our heartache, they don't have to see what people in our community have gone through, what they have already done to us?

I think that the Air Force is maybe going to be a scapegoat for the Department of Energy, because frankly, the Air Force is probably looked upon in a higher light than the Department of Energy because of their track record. Well, now you are going to be right down there in the dregs with the Department of Energy, if you continue this. I think that's why you were brought in. I don't see the difference between the Timberwind and this. There is no difference.

We are maybe not nuclear scientists. We are maybe not as educated as the people making these decisions. But we are living the results of what they decide and what you decide and what you take home to them.

41 We see no reason for this. I don't see any
2.1 reason for this to be anywhere, anywhere on our planet. There's no economic reason for it. We have created so many things now that we can't destroy, you don't know what to do with the waste. You already have the waste products. Look what's happened to Hanford, not only just what's happened at Nevada Test Site, but all over, from all this technology. You are killing us with your technology.

We need help in the everyday things. We need

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help cleaning up the mistakes you have already made.

We need help surviving with our families and trying to live our lives the way we had chosen them to be. And if our government is for us and by us, then why, what we are saying, why is it irrelevant? Why aren't you listening? Why is it not being heard? For 40 years the people in these areas have been asking why.

You have spent millions of dollars, you've already spent million of dollars on propaganda, on films, on meetings, on boring meetings, these are boring, this is boring, you know, this can be really boring. It's hard to get people to come here, you know, when you've got a lot of other things on your mind, your everyday life, this isn't a priority, unless you don't have a choice, unless have experienced something that you can't sit home. I would have rather been home. I can't sit home and not say something.

You talk about environmental impact, economic impact, when we've got people, homeless people, we've got -- our health care stinks, there's no money. And you are putting billions of dollar. We have a compensation bill through Congress that compensate the people that have lost people in this area already, $50,000. The total compensation bill will be 100 million dollars. One test -- one test, underground test at the Nevada Test Site exceeds the cost of 100 million dollars. There have been over 1,000

Document 2

tests at the Nevada Test Site, and you are going to compensate us for the life of our loved ones the price of one test.

When the Test Site was supposed to be put, when they were doing the study to the put the test site, they were told that Lake Mavua would be a less environmentally damaging place, but we were less populated here and it was predominantly Mormon and they don't speak up and don't make waves and don't cause trouble.

Well, we've spent 40 years breathing your dust and your dirt, and we don't want it anymore, and we want to have the say, and we want our Congressmen and our Senators and our government officials to listen to us. It's time we had some say here.

COL. MUEPEL: Orson Scott?

MR. SCOTT: That's me. I spoke already.

COL. MUEPEL: I'm sorry. Either we had two cards or -- no, we had Orson and Eve Scott was on the other one.

MR. SCOTT: Eve is my wife.

COL. MUEPEL: If Eve wants to speak, since we've got two, I'll let her speak. We'll do it that way.

MS. SCOTT: I will make it short and sweet. I have had a previous husband and two grown children in the prime of their life that have died from cancer. It's not a

Document 2

pretty sight. It's a heart breaking experience, and there's no money in this world that can replace that loss. And if these nuclear things are causing cancer, then I am definitely against it. So I say no, no nuclear testing here. Thank you.

J 13.4

COL. MUEPEL: Thank you. Effie Latschkowski. To be followed by Dolly Big Soldier.

MS. LATSCHKOWSKI: Many of the comments that have been made previously I agree with wholeheartedly. And I live in Washington, Utah, which is just two miles from this metropolitan area.

I moved here about five and a half years ago, and I am now acquainted with people much like those that have testified tonight of the heartache that their families and some of the remaining, though, that haven't died are still suffering.

I feel, as I have sat here and listened to the information, and I believe another person has said enough is enough. I, too, feel guilty to say, well, put it someplace else. And I am not going to argue whether it has merit to continue or not. I am not a nuclear scientist and I don't know if it has merit.

But I do feel that if there is another site to be considered, and it is a valid pursuit, put it somewhere else. This place, the people of this area, paid enough.

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The price is great that this area has paid to pursue nuclear testing.

And so, also, Wednesday I read in the paper, and if this is correct, that in Idaho 400 people showed up at a meeting and 99 percent of them said that they wanted this testing, this facility, in their area. If that's correct, then I would say let them have what they want. That we don't want it here.

And I feel guilty in saying put it someplace else, but, as a resident of this area now, I don't want to be a guinea pig. I don't want my family to be, my friends, my neighbors, my associates. And I feel that that's what we would be. And if we don't learn from history, what can we learn from?

And I, too, feel like you are here kind of as scapegoats. I'd hate to have your job. I would like to have the people that are going to make the decision, whether we have to have 30 or 40 years, look back and have the same thing that we are looking back on now here to hear us. And I hope that they will view the videos, listen to the testimony and they will make a good decision.

But I, too, I don't have a lot of faith in what the government tells me anymore, especially about this.

And I wish others were here to answer to us or give us input. And I feel like you are just here, doing

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through the mechanics of a process that we may have little to say about. But I felt and I stayed here late to say my bit. I do not want to be a guinea pig. Thank you.

COL. HUEPEL: Thank you. Dolly Big Soldier. And after her will be Jack Daniels.

MS. BIG SOLDIER: My name is Dolly Big Soldier. Member of Morris National Association of Radiation Survivors. I'm also their genetics defects in children. I was here in March and I spoke to you people.

I'd like to know when our freedom was taken away, when our, when we as a people had a say about what happened to us. To see what other people are making decisions for us, decisions that we don't want. And I'd like to know when that was taken away from us.

Maybe when they first started this nuclear testing our freedom was taken away from us. We as a people here in southern Utah in the downwind areas don't have a say about what's going to happen to us. As a mother, I'd like to know. I'd like to have a say in this.

48 12.61 I'd like to know what's going to happen to my children down the road. I don't want them to suffer the way that I have suffered, my health, and having our people dying. My tribe was a large tribe before. My reservation up here was filled with people. Now there's just a handful of us. Our elders are all gone. Who's going to teach our

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children our culture?

And I don't think you as a people have to have us go through this. I was born in the fifties and I have had to live with this shit all my life, and I'm tired of it. I don't want my children to live with it.

And I think enough is enough, as people have been saying this evening. We don't have any enemies left. K 13.6 I think we are more scared of each other. I think the money should be spent somewhere else. And the decision makers shouldn't be the ones to decide what's going to happen to us. I think as a people we have to vote for ourselves, and I think that's the way it should be, that he we should vote whether or not to have it.

I think tonight that most people here in southern Utah don't want this. I don't want my children to grow up wondering what's going to happen to them down the line.

COL. HUEPEL: Thank you.

After Mr. Daniels will be Rodger Peterson.

MR. DANIELS: I'm a veteran, six years in civil service, as well as my three years on active duty in the Army. And I'm a dual resident out of Utah and Idaho, where they are going to do the other shot up in Idaho Falls and out in that area up there.

I worked in the Hill Air Force Base in Utah. I

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worked at the old Naval ordinance plant in Pocatello prior to my enlisting in the military back in the 1953 area.

What I want to talk to you about tonight is the natural skepticism that you are seeing here tonight. It's based on the facts, gentlemen. I'm not picking on you as people. I understand you have a job here that you are here to do.

Our civil servants and our military have lied to us in the past. They have lied to you, too. The federal government, we the taxpayers, are now paying millions of dollars in damage, claims to friends and neighbors living here in southern Utah, northwestern Arizona and Southern Nevada. Why? Because of the so-called safe testing of the fifties and sixties.

Our kingdom, Wayne Owens aide involved in modern nuclear project, notes that the heavily centered version that we have seen here tonight includes the same sort of plan that was used during the open air tests of the 50s and 60s, i. e., let's just wait until the winds shift that will blow any possible problems away from Las Vegas and over to the small towns north of Vegas and those in Utah and southern Arizona.

With these thoughts in mind I'd like to make the following comments. One, the nuclear thermal propulsion project is an 800 million dollar plan to build ten reactors

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that have no known practical civilian application in the next five decades.

49 2.1 Two, whether it can be tested safe or not, there is no justification for endangering the environment or any human life to test something that should not be even considered at this time of national economic crisis and emergency in this country that we all live in. This is the kind of careless spending and funding that has been created this economic crisis.

I respectfully submit, gentlemen, that you and us together are living in a fairy tale world, wherein we have been taught to believe that big brother, our federal government, financed again by the taxpayers' dollars, can continue going in debt at the rate of two billion dollars a day.

And for those of you here that don't understand what a billion dollars is all about, if they'd let me put one $1,000 bill on the floor and then stack one on top of another until I reached one billion dollars, that stack, the top dollar bill would be 64 miles up in the air. Okay?

Now, the nice part of that is this 800 million dollar project is only one half, it's 80 percent of a half of the daily national debt we have in the country -- in other words, it's only 51 miles high -- to finance this project.

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Well, now, that's the down side. The up side is, we will, in fact, however, create on the up scale end of this 100 jobs at a cost of eight million bucks a job. Does that make sense to you? I'm sorry, it just doesn't make sense to me. None of that fits in my head. I just can't conceive that we are going to do this. Okay?

And if everything you say is true, and the project is safe because it's to be done in a remote area, with scrubbers in place to keep radioactive gasses from reaching the air, I still feel in your presentation tonight you fail to instill in any minds in this building any sense of urgency for this project.

In short, why do it at all? I feel no

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13.6 justification to place ourselves another 800 million dollars in debt. The debt we've got now, if we stop today, five generations down our kids would still be paying the debt we have now back to get us back even where we an say we had, per se, a balanced budget.

Gentlemen, can you buy that? I don't think you can. At least, I hope you can't. I think anybody with intelligence, my dad used to put it different, he used to say, God, in his infinite wisdom, gave thee a bone to keep thy ears from snapping together. If you accept this crap, thank God for your bone. Okay?

In closing, I wish to suggest this: Let's just

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fix America first. Let's just fix America first.

Then, if we have got this national budget handled, let's talk about aerospace. I don't want you guys out of a job. But I don't want any more debt, either. Let's just pull in our horns, fix America first.

I think the neatest thing I saw in this film was the very tail end of it, and it said, let's exercise the no action alternative. Thank you.

COL. HUEPEL: Thank you.

After Mr. Peterson will be Kenneth Sizemore.

MR. PETERSON: My name is Rodger Peterson. I'm running as a candidate, independent candidate for U.S. Congress. And I wish that some of the Congressmen and Senators would have been here. It's a disgrace to our country they are not. This is very important to everyone.

We have had a good story here night. I fulfilled my military obligation. I have seen the stories before. I'm acquainted with our environmental agency. I am an auto mechanic and I see what they are doing to our cars today. What we have to have to pass EPA, also, the automotive industry is working on alternatives for gasoline engines to do away with our pollution. I believe that we can also work on something else and have an alternative to nuclear power.

My mother was a downwinder. She had five

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operations I went through with her. I have had many friends and relatives die from cancer. My first pollution that I saw was when I was in grade school. I was out on the playground. In fact, Senator Jake Garner was out on the same play ground when this pollution floated over us. At that time it was called safe.

Our government has hoodwinked us a number of times. What brings to mind is some sheep that died, and our government says, oh, we had nothing at all to do with those sheep. Well, we found out later our government hoodwinked us again. Our government lied.

I am not here as a politician. I'm here as a concerned citizen, because from what I have seen in my life, back to nuclear power, I personally feel that there has not been anything in a nuclear way that I could not have got by with in my life.

I believe that the bomb that they dropped in Japan did end the war early, but what a price we have paid. What a price the Japanese paid. I am sure that it is far superior to the men we would have lost in the military to achieve the same goal.

I have seen what went on in Korea, I have seen what went on in Vietnam, and I have put my life on the line to pay the ultimate price for Old Glory, and I will do it again today. But they are asking us to go too far here.

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I think that our knowledge that we have gained through these tests that have been in the past, we have gained a lot of knowledge about everything in the last 40 years, and hopefully, our scientists and the people in power have knowledge to understand and control such a situation. But I really doubt it.

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13.9 I do have one question. Are these proceedings going to be looked at and taken into account, as they should be, or are they going to go back to Washington D. C., classified as probably top secret and put in the archives?

COL. HUEPEL: Well, first of all, the Draft EIS is not classified. Nothing in these will be classified. And that's the purpose of the hearing, is so that the people that are going to be making the decisions will have an opportunity to read what is all available, have all the comments here analyzed and then make the decisions.

LT. COL. BAUMGARTEL: The comments verbatim become, either written or oral, tonight will become part of the document itself. They will be included, attached with the Draft EIS in the final. They will be in there.

And then we specifically will have to address each one on how we answered your question.

MR. PETERSON: But let's hope that it works that way. Because we in the audience feel that we are just -- well, it's a kangaroo court. That's the way we feel.

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sitting back there. I mean, no offense to you gentlemen. I know how the programs work. And that is why I believe that as a citizen I have to do something about it. And I would suggest that all of us write our Congressmen and Senators and ask them why they are not here. Thank you.

COL. HUEPEL: Thank you.

After Mr. Sizemore will be Steven Kirkland.

MR. SIZEMORE: I'm Kenneth Sizemore. The Director of Community and Economic Development with Five County Association of Governments. That association represents locally elected officials in Beaver, Garfield, Iron, Kane and Washington counties in southwestern Utah.

We deal with issues that transcend our individual jurisdictional boundaries and try to do area-wide planning and respond to most every EIS that comes out and affects the land base of southwestern Utah.

We do have a number of convictions about the Draft EIS. Number one is the mailing list shows only the Washington County Commissioners receiving a copy of the Draft EIS. There are four other county commissions who are interested and who would like to be included on that mailing list. And I would request that they, Beaver, Iron, Garfield and Kane county commissions, be afforded the opportunity to receive a copy of the Draft EIS.

Secondly, and this is a concern that we express

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over and over and over again as Draft EISes are produced by various branches of the federal government.

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Federal law requires that a Draft EIS and final EIS talk about coordination and consultation with other governmental entities.

Chapter 5 of your Draft EIS consists of a list of seven entities that were coordinated with, but it doesn't say what they said or what coordination was done, and there are no local governments on this list. None, whatsoever. There are some state government entities, but no local governments, whatsoever.

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We feel that that's a grave injustice to local governments in the areas effected, and that some effort needs to be made between the draft and the final EISes in coordinating with the local governments that are effected by this action.

Finally, the local government officials of southwestern Utah have some strong feelings, and you've heard them from the citizens themselves this evening, about the affects of in-the-air testing. They do have those concerns. I won't reiterate what you have heard this evening.

But I would remind the audience here that the kinds of wastes that are going up and down I-15 now and that are included in the transportation that's happening right

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now are probably much greater than what has been documented in this final EIS, and we need to be putting things in perspective.

And I hope that the citizens of this area who have been here this evening have all taken the opportunity to put their names down and to get a copy of the final EIS and to review that in depth as that opportunity comes to them. Thank you very much.

COL. HUEPEL: Mr. Sizemore, can we get, perhaps, a list of the names of the commissioners that you are referring to and possible what their office address is?

MR. SIZEMORE: Certainly. I will mail that to you.

COL. HUEPEL: After Mr. Kirkland will be Barbara Prestwich. Mr. Kirkland.

MR. KIRKLAND: I am Steven Kirkland, a resident of St. George for a little over 50 years. And I was out in the open. I worked on it as a brick-layer and a farmer. I was always outside when these atomic clouds were going over. I suffered no ill effects from it. And I have only got one reason, still, right today. I've got on long handles from my wrist to my ankles, and right up here around my neck, and I wear a hat, all the time. I expose nothing to the sun or the elements except my face and my hands. And I attribute it to that.

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But I have seen people just literally roasted. One woman that I knew quite well was out gathering herbs in the mountain tops, and she come home and she was as red as a bright red beet. Every bit of her exposed body And that was the bulk of it. She was an elderly woman. And she finally just died by that just peeling off a little of at a time until it got her.

And you've heard lots of stories, and I know a whole family that died that way. And I watched these things and coming in here and thanking my Heavenly Father that my family has missed it. It's a personal family. I have a small family of 18 children 98 grandchildren and a few great-grands scattered in, and so far we've been excused from that.

And I don't condone this type of an activity at all. I don't know what we need the nuclear bombs or anything else for. Especially when, I watched one, in broad open daylight. I plotted it on a map. I was working 50 miles north of here, on home. I plotted it on a map right where that would be, and I was told the time they were going to set it off, a bright, sunshiny day, and my helper and I walked out there and set ourselves down on a pile of bricks and waited just less than five minutes. And you could see it in broad open daylight, just like that.

And, in about three or four hours, here came

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that old murky, dark reddish, or what you'd call clotted blood color almost, diluted a little bit, of course so you could see through some of it, right over us, with all the fallout that it carried.

N 13.4 I'm against this kind of stuff with everything I've got. I think there's a better way to destroy the world than this, and more mercifully. Thank you.

COL. HUEPEL: Thank you.

After Ms. Prestwich will be Diane Tew.

MS. PRESTWICH: My name is Barbara Holt Prestwich. I live in Kanarraville, Utah. I teach school at Cedar City High School. First, I want to say that I am grateful that Congressman Wayne Owens helped us to get these hearings here in St. George, both the scoping one and this one. From what I understand, originally we were only scheduled to have hearings in Las Vegas and Salt Lake. I think that would have been a serious error.

In listening to your presentation, we've noted that narrowing the choice of sites, the two in question, one of the primary considerations with it must be away from urban areas.

I think we have heard that before. The comparisons from the Colonels here about the levels of possible radiation exposure could probably be accurate. The Draft EIS says there is little danger for the testing

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phase.

But the next step, the actual firing and ongoing use of a nuclear rocket will be very, very dangerous. All we need to do is think, just think about the Challenger that we saw disintegrate, and then imagine the much worse scenario with a nuclear rocket.

Just this past June on Father's Day I listened to my brother tell me about being a little nine-year-old boy working in front of Ed McCarter's Barber Shop here in St. George, shining shoes. He just happened to be there and watched the day that the propaganda was being filmed that showed the people of St. George safely going on with their lives during the above-ground nuclear testing of the 1950s.

I hope that these videos and films that you are doing, that you are getting of these proceedings, will be viewed. I would hope that you gentlemen would take the time to dig out those old propaganda films that do exist that showed the people of St. George going about their business.

The purpose of those films was explained to us at the time, to help the people understand how safe we really were.

Now, to look at only the testing phase, and not the ongoing final phase, to tell us that it will be safe, like going to the dentist or going up on the mountain, to look at this limited part of this big picture is just one

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more big lie.

COL. HUEPEL: Let me ask this question. This has come up several times, and with regard to this EIS is on the propulsion technology. If it were to go into any larger scale, let's say production or whatever use, would there, then, have to be some further EIS?

LT. COL. BAUMGARTEL: Yes. There would be an Environmental Impact Statement on, another Environmental Impact Statement for any future use of say, an engine using this particle bed technology.

The problem right now is there is no program specifically for the use. This is a technology application on the ground. If it gets to that point where it would be used as a booster rocket for the Air Force or for NASA, it would have to go through this whole process, and then they'd have to know the size, the amount of radioactive material that would be on board, the upper stage, what would be the risk factors if it blew up on the launch, how do you design that vehicle to mitigate some possible problems?

There's just a number of things it would go through. It would be real speculation at this point for us to get into that. This is a very small test of this part of the bed reactor. There's no flight plans. There's no -- I mean, we'd have to guess, and that's not part of the process.

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So, at a future date if it was going to be used as a potential propulsion system, they'd have to go through this process again, where would you fire this rocket from, you know, geographic location, what size, condition, so forth, you'd have to go through.

This is just one piece of this. This is technology now. Just like someone developed a computer chip at one point in time or transistor. They didn't know that maybe the transistor chip was going to be used at a bomb site in a weapons system when they did it, they went through that technology development.

COL. HUEPEL: Diane Tew will be next, to be followed by Jan Lindell and then Robert Hands.

MS. TEW: Were you the men that were at the hearing in Las Vegas?

COL. HUEPEL: I was not. I'm not sure --

MS. TEW: Were you at the hearing in Las Vegas?

LT. COL. BAUMGARTEL: Yes. Two days ago?

COL. HUEPEL: I'm sorry. I thought you were talking scoping. I'm sorry. Yes, we were all there.

MS. TEW: Were they in favor, generally, of this process happening in Nevada?

COL. HUEPEL: There were pros and cons. We had both sides there. And I would be hesitant to say who was more -- whether there was more in favor or more opposed.

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There were both persuasions there.

MS. IEW: Nevada basically reaps many of the benefits from having this Test Site in their state, and I feel if there's any side effects from having it, they should also experience those and have the wind blowing towards Las Vegas, if they have to have the nuclear tests.

I am also opposed to the underground tests at that site. You said that the reason to select that site was because there was nuclear testing already being done there so it's just great and okay to have it there because it's already being done there.

I am opposed to it even underground, because it is vented. And I know someone who has lived here for seven years, almost seven years, and he experienced nuclear radiation side effects, about 10 of them, in that period of time. And I don't know that there's been any aboveground testing in that period of time.

So he experienced it from the venting of the underground testing. And I think that it's not fair to the people here. Let them live in Las Vegas. If they are the ones that are going to benefit from it, let them experience the problems of it. I don't think anybody should have to experience the problems of it. I think they should just stop the testing, you know, that they blow up. Already, you know the kind of damage they can do, already. Why endanger

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anymore people, and animals, and plants and everything.

I have chosen to come here, oh really? There's the Nevada Test Site, and you kind of dismiss it. Since moving here I wonder how smart of an idea that really was. That's all I have to say.

COL. HUEPEL: Thank you.

Jan Lindell? Robert Rands?

MR. RANDS: I'm Robert Rands. I am a retired engineer, moved here from California. I'm a home owner. I haven't been here that long. But when I retired and told people I was going to move to St. George, they asked me if I was crazy. And they said, you are going to move to an area of known radiation danger, and it may even continue. And I am sort of wondering about that now from what I have heard.

I'm concerned about it. I think the citizens of this area have a right to be concerned about it. I'm concerned particularly about what could happen under adverse test episodes. We are definitely downwind. There's no question about that.

I'm concerned about the technology and what could happen if there is an adverse episode. I know you have probably considered the worst cases. But I am not sure about whether all the adverse cases have been considered.

I didn't have the opportunity of studying the impact report, the draft impact report, because I read in

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the Spectrum the only copies that were available were in Las Vegas. Apparently there were here in St. George but the paper didn't say so, so I didn't have a chance to look at it.

So I'd like to ask a couple of questions in that regard. I really don't expect a answer here. I'd like to ask the questions and then if there's time afterwards, maybe some of them could be answered.

One of them are the pellets. We were told they were going to be about the size of a grain of sand and they are coated with some pretty exotic materials.

Obviously, the coating of these, of the uranium, is going to be a complex and difficult manufacturing process, because I am sure that in order for them to withstand the tests, the coatings have to be specific thicknesses and purity and all those things, which can be very difficult to obtain.

We have been told that they have been tested up to 5,000 degrees, which is the operating temperature of the rocket.

46 What happens if they reach a temperature of two
or three times that through some adverse test condition? Do
12.12 the pellets stand up under those conditions? And if an
explosion occurs in the rocket during testing, are they
going to be broken up and thrown out into the sky as dust,

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46 cont'd to be carried downwind to the various locations in southern
Utah or even if they don't be broken up into small
particles, are they small enough that they will be thrown
12.12 high enough in the air that they would be carried into other
locations downwind?

46 The hydrogen gas that you are talking about, starting with liquid hydrogen and then being turned into a gasification in the rocket itself. Not talking so much about the gas as it comes from the rocket, but you are going to have large containers of liquid hydrogen.

If something happens to the container and the
gas escapes, the liquid escapes and gasifies, I'm not sure,
from my own experience, what happens to a large cloud of
12.15 gaseous hydrogen. As it travels, it's lighter than air so
it's going to stay closer to the ground, and as it's blown
downwind, it will diffuse with oxygen in the air.

How long will the combustible mixture exist? Has that been considered? In a large cloud -- I'm sure you will have several thousands or maybe tens of thousands of gallons of hydrogen, liquid hydrogen, in storage for these tests. And if that escapes into the atmosphere, how long will it drift through the air downwind before it becomes noncombustible? Because it will stay to the ground.

And would certain adverse weather conditions make this cloud last longer than other conditions and, in

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46 cont'd 12.15 other words, would the weather be an effect upon such a thing?

I'm a little unfamiliar about this flare you talked about.

47 3.13 Is that after you scrub, supposedly scrub the gaseous hydrogen to eliminate the radioactive material that may be in there? Is it then burned off or just put up into the air?

Okay, one last question.

48 1.23 What happens to the EIS if after the project starts, if a lot of the parameters that have been described which made the EIS acceptable now are found to be considerably different? Does that stop the project or does it just continue to go on? Thank you.

COL. HUEPEL: Thank you.

LT. COL. BAUMGARTEL: We could answer some of those questions.

COL. HUEPEL: Okay. If you've got some answers, go ahead.

LT. COL. BAUMGARTEL: I'll let Col. Bleeker talk about the pellets, quality control during the testing.

LT. COL. BLEEKER: On the pellets themselves, we have made quite a few of them, several hundred thousand, as a matter of fact, and do the testing that we have done so far and we are able to turn out quality control for the rocket engine we are talking about, we are talking about somewhere in the quarter of millions of these kind

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of things. Automated testing methods would be developed to do that.

A number of questions that that gentlemen addressed are treated perhaps with what we might call excruciating in the EIS. I recommend he does get a copy and take a look at it.

LT. COL. BAUMGARTEL: You are talking about worst case scenarios? We did run those. We did look at hydrogen explosions. Hydrogen is lighter than air so it will rise or mix, if you are worried about a cloud of hydrogen over St. George exploding, moving over and exploding.

LT. COL. BLEEKER: That's exactly why we flare we burn the hydrogen out so there is no cloud.

LT. COL. BAUMGARTEL: And the calling for various decision to move along with the project the EIS is a legal document. They use that in their decision to make -- use it as tool in making their decisions

COL. HUEPEL: Okay? I was just going to do what -- Mr. Hanson just handed me a note. I was going to ask whether there's anyone -- Mr. Hanson is one -- whether there's anyone who turned in a card whose name I did not call?

Mr. Hanson, if you'd go ahead and come on up. Is there anyone else who turned in a card and I did not call

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your name? Mr. Hanson, you will be the last speaker.

MR. HANSON: Thank you. I'm Roger Hanson, a resident of St. George, and I don't speak for any particular group, but I do believe I speak for many.

Gentlemen, I have grave reservations about the accuracy of statements regarding environmental impact, when such statements come from the military establishment.

I recall with deep resentment the repeated denials about the nerve gas testing at Dudley Proving Ground and that it had anything to do with the death of hundreds of sheep up north. Years later the cause-effect relationships were finally admitted, only after it was impossible to do otherwise.

Farther south, in this area, the downwinders have struggled for decades against a stonewalling governmental bureaucracy, where we are out-gunned, out-manned, out-maneuvered, out-shuffled. Our appeals are met with prevarication. It has become clear, we cannot trust the accuracy of statements regarding environmental impact when they come from the military establishment.

Further, the deponent sayeth naught.

COL. HUEPEL: We have mentioned it before. Just in case there's any question, if you want to get a copy of the draft EIS, there is a copy. I presume it may only be one copy in the Washington library, or Washington County library

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here. But if you want a copy of the draft, you can put that down on one of the cards. If you want a copy of the final EIS you can indicate that.

You have until the 5th of October to submit any written comments that you might want to submit or any citizen has got that right, whether it be some friends or anyone else. If you want to submit comments, you can do that. And it would go to the address that's listed at the bottom of either the written comments sheet, or it's also listed inside the hand-out, on the second page.

We do appreciate your comments and we appreciate your involvement tonight. Thank you very much, ladies and gentlemen.

* * * * *

(Whereupon, the hearing was concluded.)

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CERTIFICATE OF REPORTER

STATE OF NEVADA)
) ss.
COUNTY OF CLARK)

I, Harold St. Thomas, Certified Shorthand Reporter, do hereby certify: That I reported in shorthand (Stenotype) the proceedings had in the above-entitled matter at the place and date indicated. That I thereafter transcribed my said shorthand notes into typewriting, and that the typewritten transcript is a complete, true and accurate transcription of my said shorthand notes.

IN WITNESS WHEREOF, I have set my hand and affixed my official Seal in my office in the County of Clark, State of Nevada, this 23rd day of September, 1992.

NOTARY PUBLIC
County of Clark-State of Nevada
HAROLD ST. THOMAS

HAROLD ST. THOMAS, CSR NO. 130

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SPACE NUCLEAR THERMAL PROPULSION

PUBLIC HEARING

TAKEN AT THE CLARION HOTEL
SALT LAKE CITY, UTAH
September 15, 1992
REPORTED BY: Jody Edwards, CSR, RPR

CAPITOL REPORTERS
175 South Main, #610
Salt Lake City, Utah 84111
(801) 363-7939

File No.

Document 3

September 15, 1992 7:00 p.m.

Space Nuclear Thermal Propulsion Public Hearing

P R O C E E D I N G S

COLONEL HUEPEL: Good Evening, ladies and gentlemen. Welcome to the public hearing on the Draft Environmental Impact Statement for the Space Nuclear Thermal Propulsion Program. I want to thank you for coming tonight. And I solicit your comments and your involvement in tonight's hearing. We don't have ashtrays here, so I would ask you not to speak. Hopefully, I think with the sound system we've got, you should be able to hear, but if you have difficulty hearing any of us, if you'd raise your hand back and forth, we'll see if we can do better. And, finally, for those of you in the back, it may be a little difficult seeing the view graphs, so if you want to come up a little bit closer at any time, I invite you to do that.

I'm Colonel Jim Huepel. And I'll serve as the presiding officer for this public hearing. I'm the chief trial judge for the Air Force and I'm assigned to the Bolling Air Force Base in Washington, D C. I'd like to introduce to you the members of tonight's panel. In the center to my right is Lieutenant Colonel Gary Baumgartel, who is the chief of the Environmental Planning Division at the Air Force Center for Environmental Excellence in San Antonio, Texas. To his left is Lieutenant Colonel Gary Bleeker from the Phillips

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Laboratory at Kirtland Air Force Base, New Mexico. Now Colonel Baumgartel will describe the environmental impact analysis process and the results of the environmental analyses. Colonel Bleeker will brief you on the proposed action and the alternatives for the program.

Now also with us on Colonel Baumgartel's right is Mr. John Lepper from the Dep[illegible] Energy's Field office in Las Vegas, Nevada. Now [illegible]ment of Energy is what we call a cooperating agency i[illegible]gram. And it participated in the preparation of this Draft Environmental Impact Statement. Now, Mr. Leppert will be available to answer questions that you might have concerning the Department of Energy's involvement with this program.

As the presiding officer for this hearing, I am not acting as a legal advisor for this action. I'm not here as an authority on the Draft EIS, I've not had any involvement with its development or preparation. My purpose tonight is to ensure that we have an orderly hearing and that everyone who wishes to provide input or to make a comment or to ask a clarifying question, has a fair opportunity to speak and to be heard.

Now I'd like to explain to you the public hearing process and the procedures that we'll follow this evening. The Air Force has prepared a Draft Environmental Impact Statement, we call it a Draft EIS, on the Space Nuclear

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Thermal Propulsion Program. Now that was done in accordance with the National Environmental Policy Act, sometimes referred to as NEPA, and also Air Force implementing regulations. The purpose of this hearing is to summarize for you the results of the Draft EIS and to receive your comments on the Draft EIS.

Now, tonight's hearing will be in two parts. During the first part Colonel Baumgartel and Colonel Bleeker will present information to you concerning the environmental impact analysis process performed for the Space Nuclear Thermal Propulsion Program. The second part of the hearing is the public participation portion where you'll have the opportunity to comment on the Draft Environmental Impact Statement or to ask clarifying questions. This hearing is intended to provide a public forum for two-way communication about the Draft EIS, with a view to improving the decision-making process. Your inputs ensure that the decision makers may benefit from your knowledge at the local area and from any adverse environmental effects that you think may result from the proposed action or the alternatives to that action.

Let me say what this hearing is not. It is not a debate, nor is it a referendum. It is also not a vote on the actions that have been analyzed in the Draft EIS. The focus of this hearing is on the environmental impacts associated with the proposals being studied by the Air Force. So comments on non-environmental issues should not be raised at

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the hearing. Moreover, none of the panel members are the Air Force decision makers on this project.

Now, when you came in tonight you were provided with an attendance card and you were asked to indicate on it whether you wish to speak tonight. A card, a small card like this. After the presentations by Colonel Baumgartel and Colonel Bleeker, we'll take a short break and following that break, you'll have a five-minute opportunity to speak or to ask clarifying questions or to do both. Elected public officials, who will be called on first, followed by the public at large.

Now I'll use these cards to randomly call on members of the public at large. If you've not had an opportunity to fill out a card, you'll have that chance at the break. If you'd like to get one of the cards now and fill it out, just raise your hand and we'll have someone get a card to you so it can be filled out. But there will certainly be that opportunity at the break to fill out a card and then turn it in.

If you brought a prepared statement tonight, you made read that statement out loud, you may leave it in the box by the microphone, or you can do both. Either way, it will become a part of the public record.

Now, if you don't want to make a statement tonight, but you would like to provide your input, you may do so in

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writing. And for your convenience, written comment sheets are available at the registration table. You can use these sheets or you can do it on your own stationery or submit your own documents. However, I would just point out that the address where the written comments need to be sent are listed at the bottom of this form. They're also listed on the second page of the agenda that you may have been handed.

Now any comments that are made, whether they're given orally or provided in writing tonight or submitted later, will be given equal consideration in the decision-making process. In summary, I'd just like to stress that this is your opportunity to provide the Air Force with any information that you may have regarding environmental factors that are unknown to us and to have inputs into the decisions that the Air Force must make regarding the proposed action. Now Colonel Gary Baumgartel will describe the environmental process.

LT. COLONEL BAUMGARTEL: Thank you, Colonel Huepel. Good evening. I'm Lieutenant Colonel Gary Baumgartel from the Air Force Center for Environmental Excellence at Brooks Air Force Base in Texas. Our organization is independently conducting the environmental impact analysis process for the Space Nuclear Propulsion Program.

Tonight I'll present the schedule for completing this environmental impact process and show how the present

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public comment period fits into the schedule. Also discuss the scope of the study. And then Lieutenant Colonel Gary Bleeker will then present a briefing on the proposed action and the test location alternatives. And lastly, I will present the results of our analysis.

On March 13, 1992, a notice of intent to prepare an Environmental Impact Statement on the Space Nuclear Thermal Propulsion Program was published in the federal register. Four scoping meetings were held in April 1992 to receive comments from the public concerning the scope of the issues to be addressed in the Environmental Impact Statement, or EIS.

At the scoping we collected the necessary data and conducted the analysis. And the Draft Environmental Impact Statement we are here to discuss tonight was filed with the U.S. Environmental Protection Agency on August 5th -- 14th of this year.

The public comment period will extent until October 5, 1992. And the final Environmental Impact Statement is scheduled to be completed in December. Once this is complete, the EIS will be used by the Air Force to help decide whether or not to proceed with the test program to validate the concept behind the Nuclear Propulsion Program. We expect to accomplish a record of decision in January 1993.

A copy of the Draft EIS was mailed to all groups and individuals who requested one. In addition, these libraries

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in the state have a copy available for review. Also, a copy may be requested tonight or by writing to this address that's shown.

In addition to tonight's hearing, written comments on the Draft Environmental Impact Statement will continue to be accepted at this address until October 5th of this year. After the comment period is over, we will evaluate all comments, both written and oral, and perform additional analysis or change the environmental impact statement where necessary. Again, as in the scoping process, equal consideration will be given to all comments whether they are presented here tonight or received prior to October 5th. Comments received after that date may not be considered in the final Environmental Impact Statement because of schedule constraints. Once the review process is complete, we'll produce the final Environmental Impact Statement and mail it to all of those on the original Draft Environmental Impact Statement distribution list, as well as those who request a copy between now and the mailing date. The final impact statement will include comments received during the public period and our responses to those comments. Following completion of the EIS, the Air Force and DOE will consider environmental impacts, as well as other factors such as economic and technical considerations and program goals, before deciding whether to proceed with the SNTP program. The

decision will be documented in a record of decision. Now I'd like to present Lieutenant Colonel Gary Bleeker to my left from Phillips Lab who will describe the Air Force's proposed plan for the SNTP.

LT. COLONEL BLEEKER: Good evening, ladies and gentlemen. I'm Gary Bleeker, the program manager for the Space Nuclear Thermal Propulsion Program at the Air Force's Phillips Laboratory, Kirkland Air Force Base in New Mexico. Tonight I'd like to tell you about the Space Nuclear Thermal Propulsion Program and our proposal to develop and to validate the particle bed reactor propulsion technology.

The program's mission is to develop and validate nuclear reactor technologies to be used as advanced space propulsion systems. Several propulsion technologies have been and continue to be considered as viable research options. However, the Air Force considers the particle bed reactor propulsion technology to have sufficient developmental potential to warrant continued investigation.

Before we go any further, I'd like to explain how the SNTP program was formed. Approximately two years ago, work was begun on an Environmental Impact Statement to support certain decisions concerning a classified program. A particle bed reactor technology was one of the state-of-the-art technologies being developed under this program. However, because the program was classified, the Environmental Impact

Statement was classified and prepared without public participation. Because of changing mission requirements, the program, code named Timberwind, was terminated.

The Air Force, recognizing the potential of the particle bed reactor concept, took over responsibility for developing the particle bed reactor. The program office was formed in 1991 to lead and manage the developmental effort. In assuming this responsibility, the Air Force determined that rather than to rely on that classified EIS, about which the public knew nothing, we would prepare a new Environmental Impact Statement for the program with full public participation.

In short, the Air Force wants to fully develop and validate the technology that was started under the Timberwind program. The Air Force goal is to demonstrate the feasibility of a particle bed reactor propulsion system that could be operated outside the atmosphere in space as an advanced upper stage or an orbital transfer vehicle.

As stated in the notice of intent, the decisions to be made, based in part on this Environmental Impact Statement are:

A. Whether to continue the SNTP program through to development of nuclear thermal propulsion technology.

B. Whether to construct and operate a validation test facility.

C. Where to locate the validation test facility.

Two sites are being considered for locating the validation test facility, and both were studied in the Environmental Impact Statement. One is at the Nevada test site and the other is at the Idaho National Engineering Laboratory. When this Environmental analysis was begun, a third site called "Quest," also at the Idaho National Engineering Laboratory was also under consideration. However, as a result of our investigations, it was eliminated from further consideration due to the presence of significant cultural resources.

Before we get into the details of the program and specifics of our proposed action, I'd like to provide the description of conventional chemical and nuclear propulsion systems and why the premise of nuclear propulsion is so profound. First, the ultimate objective of any propulsion system is to produce very hot gas for propulsion.

In a conventional chemical propulsion system, shown on the left, two fluids, a fuel and an oxidizer, are mixed and they are burned. When proper combustion occurs, a large volume of hot gas is generated. This hot gas expands through a nozzle to produce thrust. However, there are only a few acceptable fuel and oxidizer combinations, and efficiency and performance of chemical systems are limited by both temperature and the molecular weight of the gas after the

combustion process is complete.

A nuclear propulsion system contains a reactor which replaces the combustion process in a conventional system. Thus, the reactor essentially becomes a very powerful heater. It heats a single fluid, the propellant, to a very high temperature. The propellant flows through the reactor, becomes very hot, is expanded through a nozzle and produces thrust in the same manner as a conventional rocket.

Both chemical and nuclear propulsion systems operate at temperatures around 5,000 degrees fahrenheit. But the key difference between the two is that with a nuclear propulsion system, we can choose the propellant. By choosing the lightest propellant, hydrogen, a nuclear propulsion system can be made more than twice as efficient as a conventional one. The theoretical effect of doubling this efficiency is that the load-carrying capacities can be increased somewhere around eight to ten times. However, as a practical matter, we can see real costs and weight reductions by the factor of two to five. This means a tremendous monetary savings with a safe high performance nuclear propulsion system could be developed.

The particle bed reactor, or PBR, is viewed by the Air Force and others as having distinct performance advantages. The particle bed reactor would use spherical fuel particles. The typical fuel element would contain many millions of these fuel particles, each approximately the size

of a grain of sand. The typical particle contains a center of fully enriched uranium 235 surrounded by a porous graphite buffer layer. Next is a high-density graphite layer which is surrounded by a final layer of zirconium carbide. These multiple coatings provide containment of fission products and prevent the heated hydrogen from damaging this material. The six-sided fuel element includes neutron moderator material on the outside, concentric filters or frits and fuel particles. The concentric filters are devices that support the fuel particles while allowing hydrogen to flow through that material and cool those fuel particles. The flow path through an element are illustrated in this figure by arrows. An array of hexagon-shaped fuel elements would be surrounded by a neutron reflector such as graphite or beryllium to enhance reactor performance. And it also contains reactor control devices. The number of elements used could be tailored to produce desired thrusts.

The general concept of a propulsion system in the lowest use of particle bed reactor to heat low temperature liquid hydrogen propellant to very-high-temperature gaseous hydrogen, the hydrogen is not burned but is simply exhausted through a nozzle to produce thrust.

The major technical goals of the program include achievement and control of nuclear power levels, development of materials that can withstand these high operating

temperatures in the hydrogen environment, a reliable control of the high and the low temperature of the hydrogen propellant.

In addition to the particle bed reactor itself, the principal components of a conceptual propulsion system are the propellant management system in the one box, and the pressure vessel nozzle assembly.

The propellant management system provides controlled flow and pressure to the reactor and other subsystems. During the operation, low temperature hydrogen exits the propellant tank, enters the turbo tank assembly. After exiting the pump, the propellant is delivered to the reactor where it's heated to the desired temperature. A small portion of propellant is bled off to power that turbopump assembly.

The pressure vessel and nozzle assembly would provide pressure containment and constructural support. The nozzle collects the hydrogen gas from each fuel element and accelerates the gas through the throat section to generate thrust.

This leads to the description of the proposed validation testing of the particle bed reactor propulsion technology. The proposed testing sequence involves a series of tests over a five to ten-year period leading to the validation of the concept. As shown in this slide, the tests are sequenced to begin with fuel element testing and culminate

in testing of an integrated system. In the building block approach, this test series includes the particle bed reactor performance element test, and engine integration test, culminating with tests of ground test articles or engines. All these tests would involve reactors within a test cell and within properly contained facilities.

Each test series would be carefully planned to include written procedures and formal review and approval. Each test sequence would undergo a comprehensive safety analysis before approval to proceed would be granted.

The multiple fuel element test would be the first sustained power producing test. These tests would involve a reactor about the size of a 55-gallon drum, and would be used to demonstrate the performance reliability, operability of fuel elements. Each of these cores involved in the test could be subjected to five operating cycles at a maximum power level of 550 megawatts for as long as 500 seconds or about 8 minutes. This is the energy equivalent of a Boeing 747 flying for 40 minutes. Up to ten of these tests may be conducted in a single year. The non-nuclear turbopump test or what we call engine integration tests, would be designed to demonstrate proper function of the propellant system without an operating reactor in the loop. This series would establish confidence in the control and the feed system necessary to allow proceeding to engine system tests.

These integrated system tests would be a series of ten reactors which gradually approached the desired performance conditions. Its design would evolve from technical information derived during earlier testing. Two versions would be tested, they're referred to as mini or sub-scale and full-scale.

Subsequent to satisfactory operations with the element testing many system tests would be tested in the same test cell used for those earlier tests. The full-scale test series would take place in an expanded facility and would demonstrate complete operation with feed and control hardware and a full complement of instrumentation. This full-scale engine would be approximately the size of a small automobile. Multiple tests would be performed beginning at zero power, to low power, to operational power and temperatures. Each test would demonstrate controllability and stability at full power and the rapid start-up and shutdown under computer control for a full mission profile.

Each test would be in order of a few minutes in duration. The maximum time of a full powered reactor for any individual core would be approximately 1,000 seconds or 20 minutes. The energy produced from such a test would be equivalent to a Boeing 747 flying for approximately four and-a-half hours.

Next slide, please.

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Because no facility exists that fully meets these testing requirements, construction of a new facility or extensive modification of an existing facility is required.

As shown in this slide, the main features of the facility include a control complex which has an instrumentation and control system inside of a bunker, a test cell, a confinement system, a coolant supply system, and then an effluent treatment system.

That control complex, at the top, would be a shielded reinforced concrete building from which access to the facility, any activities involving the test cell, and a system to provide video surveillance over the entire test facility would be controlled.

The control system would provide the required safety and control functions for all operations at the entire test facility. And the system would provide remote control of all functions associated with reactor testing.

The sub-scale facility would also include a test cell to accommodate the major components of the reactor for initial validation tests.

The confinement system limits the release of fission products, would include a barrier enclosing the reactor and portions of the effluent treatment system.

The fluid systems for the sub and full-scale test facilities would consist of two major subsystems: The

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incoming coolant supply system and the outgoing effluent treatment system.

The incoming coolant supply system would be composed of a hydrogen storage system, helium storage system, and of pipes and valves for coolant distribution.

There are a number of -- three major reasons for incorporating an effluent treatment system in the test facility. First, one of the goals of the testing is to validate design margins. Secondly, the emissions of radionuclides in the ambient air from Department of Energy facilities are regulated by the Environmental Protection Agency in accordance with the national emission standards for hazardous air pollutants, and shall not exceed an amount that would cause any member of the public to receive in any year an effective dose equivalent of ten millirems. While these national emission standards may allow a member of the public to receive a dose of ten millirems a year, the SNTP program is committed to a design goal of two millirems per year, or 20 percent of the allowable regulatory limit. Because the program is a developmental program, there would be some uncertainty in the actual composition of the effluent. An effluent treatment system would ensure that the emissions from planned activities would remain well within these program goals. Third, it is national policy to reduce radioactive discharges to a level that is as low as reasonably achievable

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and the ETS makes this possible.

The effluent treatment system would be designed to accomplish the following objectives: It would ensure radioactive material entering the treatment system remain subcritical. Secondly, it would cool the test particle exhausts to much lower temperatures to effectively treat that exhaust. Thirdly, it would remove particulates, debris, and it would trap noble gases and contaminants from the stream. And fourthly, it flares the resulting clean hydrogen gas to the atmosphere and prevents the accumulation and detonation of the hydrogen in the vicinity of the test cell.

An effluent monitoring system would measure the radioactive and particulate content of the stream on a real-time basis and display this information for reactor operator. The effluent treatment system design would include appropriate shielding to prevent worker exposure to ionizing radiation above acceptable levels.

The design and fabrication of an effective effluent treatment system, while costly, is well within the operating ranges of state-of-the-art systems. Construction and modification of all facilities is expected to take approximately 18 to 24 months for both the sub-scale and the full scale facilities. An average work force of 35 and a peak work force of about 100 in the construction phase. The number of personnel on the site during pre-operational activities at

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the smaller sub-scale facility would be limited to about 30 security, technical administrative or maintenance personnel. The pre-operational staff of the larger full-scale facility would be approximately 50 to 60. During actual testing operations for both facilities, the number of personnel on site would be reduced to a minimum operating staff of no more than ten individuals, all located within the control complex.

Two sites of Department of Energy installations have been identified as suitable locations for the validation test facility. The Saddle Mountain test site at the test station at the Nevada test site and the contained test facility at the Idaho National Engineering Laboratory. The principal exclusionary criteria considered in the site narrowing process were: One, similar nuclear activities conducted at the installation. Two, a 15 kilometer minimum distance to the nearest urban area. And three, federal ownership of the facility. The Saddle Mountain test site is located in the center of the Nevada test site, South of Mine Mountain Road and west of Saddle Mountain Road. The distance to the nearest boundary is 14 miles, and access to the Nevada test site is controlled.

The Saddle Mountain test station would require new construction for both the sub-scale and full-scale test facilities. Other infrastructure required for the site include power lines, phone lines, roads, a line to an existing

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deep-water well, and water storage tanks. Transportation improvements include new site roads and a grading of existing access roads.

The contained test facility is located in the northern portion of the Idaho National Engineering Lab, northeast of the intersection of Lincoln Boulevard and State Highway 33.

Some existing facilities to support validation testing are already located at the contained test facility site.

Existing facilities at the site consist of a receiving, assembly, and hot cell facility, a containment structure, a control bunker, post-irradiation examination facilities, and administrative space. Approximately one and-a-half mile railroad track connects the containment structure to the receiving, assembly, and hot cell facility. A security fence with guard stations is also in place.

A number of modifications to that existing facility would be required. It is likely the control building would have to be reconfigured to accommodate the tests, and the receiving, assembly, and hot cell facility may require modest modification to accommodate the hot test particles. Engineering studies have been initiated to determine if the contained test facility or new test cells would be required for a full-scale test facility. New test cells, if required,

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would be located adjacent to the contained test facility. Use of the containment structure as the test cell would require construction of fluid storage and piping and effluent treatment system and a flare stack. Engineering studies are underway to determine renovation requirements for the contained test facility vessel.

As required by the National Environmental Policy Act, the no-action alternative was also evaluated. The no-action alternative would result in the Air Force not proceeding with the development of the validation testing program.

What I have presented here is a summary of our proposal to develop and validate the PBR propulsion technology. Many more details of the proposed action are contained in the Draft Environmental Impact Statement. Lieutenant Colonel Baumgartel will next present the environmental impact analysis for this program.

LT. COLONEL BAUMGARTEL: The Draft Environmental Impact Statement was prepared to comply with the National Environmental Policy Act and the counsel on the Environmental Quality regulations. Efforts were made to reduce needless bulk and write in plain language and focus only on those issues that are clearly related to the environment and to integrate the EIS with other documents required as part of the decision-making process.

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This analysis focuses on impacts to the natural environment that may occur as a direct result of particle bed reactor development and validation testing, or indirectly through changes in the community. Resources evaluated are air quality, biological resources, cultural resources, soils and geology, noise and water (both surface and groundwater). And indirect changes to the community that provide measures against which environmental impacts could be analyzed include changes to local employment population, land use and aesthetics, transportation, and utility services. In addition, issues related to the current and future management of hazardous materials and wastes are discussed in the document. Because the proposed action involves transportation in testing of nuclear materials, a considerable amount of health and safety analysis was done to address radiological as well as nonradiological impacts.

If, as a result of our analysis, it was determined that adverse environmental effects may occur -- impacts may occur through implementation of the proposed action and testing alternatives, then potential mitigation measures were identified and analyzed in the document also.

If a few minutes I will present the results of our analysis that are stated in the Draft EIS. Both validation test site locations were analyzed in the same level of detail. The baseline conditions assumed for the purpose of analysis

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are the existing conditions at each location. The following slides will show comparative impacts between the test site alternatives, excluding the no-action alternative.

Before I do this, I'd like to take a few moments to summarize and clarify what we've presented so far. Basically the proposal that Colonel Bleeker was talking about is to proceed with the particle bed reactor tests, which would include a construction of a facility and run a total of about 60 tests over the next ten-year period. And to locate the facility either at NTS in Nevada or INEL in Idaho. And both sites meet the program needs at this point. So the decisions we're looking at; should we do it or not, regardless of location, or if we decide to press on, then where are we going to do the tests? So that's the decisions in the documents and the alternatives.

I know it's complex as he goes through the program itself and I thought we put the slide in here just to clarify a couple of points, and there may be some confusion because there's different types of nuclear systems and nuclear testing. The point is this is not a nuclear rocket test program. It's to develop a particle bed reactor to be tested on the ground to see if the technology works. An analogy may be that somebody at some time decided to test whether a transistor would work, but they hadn't decided on what the shape of the transistor radio was going to be at that time.

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So we're in a technology of a propulsion system.

The second point is this doesn't involve nuclear detonations. This is not a bomb. Again, it's a reactor which has containment on the inside of a reinforced concrete building, it's bolted down in place, it's not going any place. The exhaust, which is hydrogen, will be captured, filtered and to eliminate any release of any radioactive materials to the environment. The effluent system then would give you that clean exhaust.

The applications of the PBR technology, some of the future uses, this is a space program, so our eyes are on potential applications in space, but it's too early to tell at this point in time whether the engine, whether it's specific impulse or any of its technical characteristics will meet any programs when we may need it. So there's no definite program, so it would be speculative at this point in time to determine what size rocket, what payload, where we would fire this off or anything. So it's too early, it's too early in the system.

I think maybe another example would be if someone came in with an idea that they're going to develop a new engine, gasoline engine that would get 100 miles to the gallon and it would be pollution free. And maybe someone would sponsor them to do the research and development on that engine. And maybe it was a car company that did that. When they finished the testing, maybe it did work, but it only

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worked up to about ten haus pe range, then it didn't work. So maybe it should have been a lawn mower company providing the funding behind it. We don't know, so we're testing the technology at this time and that would be the same kind of thing in that example.

So keeping the proposed action and alternatives in mind, let's review the environmental impacts. So this slide shows the maximum projected population employment effects from the implementation of the SNTP program. The peak year increase of 100 employees, assuming for purposes of determining maximum impact, that no persons from the local job market would be employed, results in a .04 or four-hundredths of a percent population increase in the region of influence for the SNTS, or two-tenths of a percent increase in the region of influence for the CTF in Idaho. The maximum of two percent increase in total peak year employment would occur at the Nevada site, or a one percent increase at the Idaho site.

This slide shows the utility requirements for the SNTP program at the two alternative sites.

Under energy, there is sufficient power at both SNTS and CTF for sub-scale testing. Supplemental power would be provided by mobile generators at SNTS during ground test particle operations. Mobile generators may be required to provide supplemental power during the peak demands of ground test particle operation testing at the CTF also.

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Under solid waste, an average of 175 tons a year of non-hazardous waste is expected from the SNTP program at the NTS, and is less than two percent of the total amount of solid waste generated, and would result in a negligible increase in the anticipated life of disposable capacity at the site. At the INEL, a new landfill will be operational by 1995; therefore, a negligible impact on landfill capacity is expected also at this site.

Under wastewater, at SNTS, the total estimate of 2,400 gallons per day of wastewater would be handled by a new septic system planned into the SNTP facility. An additional 2,400 gallons per day of wastewater at the Idaho site would be well within the capacity of existing evaporation pond system.

Under water supply, the .01 million gallons per day of water demand for SNTP represents a small increase in demand on the water supply systems either at the Idaho site or the Nevada site.

The construction of facilities on 100 acres in Nevada is consistent with the current missions and activities at NTS. No land-use impacts would occur. The modification of existing facilities and construction of additional facilities at CTF is consistent with their missions and activities at the INEL, and again, no land-use impacts would occur at this site either.

This slide shows the traffic impacts of increased

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employees traveling either to or from the NTS or the INEL. The maximum of 5.9 percent increase in traffic is expected along U.S. Route 95 to the NTS for construction and a maximum of three and-a-half percent increase during the operations. Assuming that most employees at INEL in Idaho would use commuter buses to get to work, the SNTP program would cause a four percent increase in traffic during construction and a three percent increase during the operations on State Route 33. None of these traffic increases is expected to cause adverse impacts to the levels of service for either of these roads.

The next two slides cover the transportation and use of radioactive and non-radioactive hazardous materials, and the storage and disposal of hazardous wastes. The health and -- excuse me -- health and safety aspects of hazardous materials and wastes will be discussed throughout.

Under hazardous materials, the largest quantity of fuel material to be transported in a single shipment would be the reactor cores. Department of Transportation, Department of Energy, and Nuclear Regulatory Commission regulations and requirements would be followed to ensure that no adverse impacts from these and other transportation activities would occur. These precautions would be required for either the SNTS or the INEL CTF site.

Under non-radioactive hazardous wastes,

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approximately 500 cubic feet (or seventy 55-gallon drums) of non-radioactive hazardous waste, consisting principally of solvents, would be generated from either site over the life of the program. All waste would be labeled, shipped to an EPA-permitted treatment storage and disposal facility.

Under low level waste, low level radioactive wastes requiring disposal would consist of solid waste from the handling, cleaning and disassembling of canister assemblies and contaminants removed from the effluent stream. Over the life of the project, it is anticipated that 1.6 million cubic feet of low level waste would be generated. This low level waste would consume 18 percent of the available disposal capacity at NTS and approximately 46 percent of available capacity at INEL.

Under mixed waste, mixed waste such as low-level radioactive materials that are contaminated by solvents or solvent residues may be generated. It is anticipated that no more than 70 cubic feet of mixed waste material would be generated annually. NTS has sufficient capacity for storage and disposal, and INEL has sufficient capacity for storage, and is awaiting permitting of a disposal facility at this time.

The disturbance of ground and construction of facilities at SNTS and CTF have generated some fugitive dust, which is regulated under the National Ambient Air Quality

Standards as particulate matter, and it would be construction vehicles. Emissions from the operational phase would include emissions from additional traffic from minor site activities, such as the use of diesel generators and flaring of hydrogen during the particle bed reactor tests. The impact on regional and local air quality from either the SNTS or CTF alternative would be negligible, and is not expected to affect the attainment status of the region's air quality.

This slide summarizes the impacts to biological resources from the project at the two alternative sites. At SNTS, there would be a loss of 100 acres of Transitional Desert Association Habitat, which is common community. Constructions of the facility's improvements to the access road may impact up to 1,000 Joshua Trees. From project operations, noise may affect -- noise may affect the wildlife and the flare stack would kill any birds flying into the flame. However, noise from the flaring would likely scare the birds away that might fly over the flare stack during operation. Therefore, no impacts to threatened or endangered species are expected.

And at the CTF, there would a loss of less than 50 acres of previously disturbed land, that is low quality habitat. Project operations (that is, again, noise and flare stack) would have similar impact as the SNTS. The only threatened and endangered species, the bald eagle, has been

observed approximately 12 miles from the CTF, and foraging near the mountains north and west of the INEL site. The only possible impact again would be from the flare stack, and this again is considered unlikely because of the distance and noise from the flaring operation.

This slide summarizes the results of cultural resource analysis for the two alternative sites.

At SNTS, seven prehistoric cites were found within the region of influence; none of these sites is considered significant under the national register criteria. Therefore, no adverse impact is expected to occurring to archeological resources. No historic, native American, or paleontological resources have been identified at the SNTS.

At the CTF, the only known cultural resources that may be affected is the existing facility at the CTF, which retains qualities that would make it potentially eligible for the national register of historic places. This is because the CTF is the only nuclear reactor test facility of its size in the world designed to simulate all of the important events that could occur in a commercial pressurized water reactor power plant. Consultation between the Idaho State Historic Preservation Office and the Advisory Counsel on Historic Preservation and INEL is addressing the issue of national register eligibility for several of the INEL properties. A memorandum of agreement to outline various mitigative

requirements is currently being prepared. Until the consultation process determines the eligibility of the CTF and national register, it will be considered a potentially significant historic resource. As such, modifications proposed by the SNTP could have an adverse effect. Mitigation measures may be required if this site alternative is chosen. If it is determined that the CTF is not eligible for the national register, then no cultural impacts are expected.

In the geologies and soils, the construction of new facilities would require the disturbance of about 100 acres of land for the SNTS, less than 50 acres for the CTF. The SNTS would require 26,000 cubic feet of material for cut and about 37,000 cubic yards for fill, while the CTF would require about 3,000 cubic yards of cut and about 4,000 yards for fill. Measures would be taken at either site to suppress the dust and soil erosion. And no impact from seismic and volcanic activity is expected at either site.

High noise levels at SNTS are not expected to cause impacts for non-project personnel. The projected 125-decibel noise level from operations would be attenuated before reaching non-project personnel in sensitive community receptors. The nearest non-project personnel would be approximately six miles away, and the nearest community is approximately 23 miles away.

Noise levels at CTF are also not expected to impact

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non-project personnel, and again, sensitive community receptors, and the nearest non-project personnel are approximately 1.3 miles from the CTF and the nearest community is approximately 11 miles away.

There would be again short-term noise effects on wildlife in the vicinity of the test facility during test operations. And as mentioned before, this may have a beneficial side effect of scaring birds a way from the flare stack during operations.

The 3.7 million gallons per year of water required for the project are not expected to cause drawdown in the aquifers at either SNTS or the CTF. No water quality impacts are expected from the normal operations at each site.

Turning to health and safety. This slide is a chart showing results from maximum case radiological modeling of normal testing operations, as compared to the national emission standards, the program goal, and the radiation dose we receive naturally. In summary, the SNTP program exposures to maximally exposed public are much smaller than the annual regulatory limit for routine exposures. These calculated exposures are also considerably smaller than the annual exposure due to naturally occurring radiation. For the NTS area, the maximum single-year exposure would be only .6 millirems, which is only .14 percent of naturally occurring exposure. For the INEL area, the maximum single-year exposure

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would only be 1.35 millirems, which is only .31 percent of the naturally occurring exposure. These doses represent upper bounds of the potential exposures, and have been calculated using extremely conservative methodology. In summary, no adverse radiological impacts are expected to result from the proposed action.

This slide shows the results from radiological modeling of the maximum case credible accident scenario. The maximum case credible accident is assumed to consist of the simultaneous failure of two critical ETS components, resulting in a release to the environment. In developing the maximum case effect shown here, all weather conditions were looked at and consideration given to multiple concurrent internal and external explosions of hydrogen.

The maximum credible accident exposure at NTS would be 23.5 millirems, or only 5.6 percent of the natural occurring dose. And the maximum credible accident at INEL would be 30 millirems, or again only 6.8 percent of the natural dose. In comparison, the recommended maximum 24-hour accident exposure level is 500 millirems, or more than 15 times the maximum accident exposure at either site.

With the normal operation exposures, the maximum accident exposures represent the upper bounds, using extremely conservative methodology. Also, the analysis does not include mitigation measures such as evacuations and remediations which

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would be undertaken in the event of an actual accident.

Looking at worker exposures, the Department of Energy suggests a design goal of 500, maximum 500 millirem annual dose for radiation workers. The 150 workers at the SNTP facility could therefore be exposed to as much as 750,000 person-millirems over the ten years of the SNTP program, and still meet this goal.

Also, a goal of the SNTP program is to maintain exposures to on-site, non-program related personnel to a much lower level of only 20 millirems per year.

Based on this goal, the 4,500 workers at NTS could receive up to 900,000 personal-millirems, or only a 4.7 percent increase over the natural exposure levels which would be 19 million person-millirems that would be received during the ten-year period of the program.

The 8,500 workers at INEL would receive not more than 1.7 million person-millirems, only a 4.5 percent increase over the natural exposure levels of the 37 and-a-half million person-millirems received in the ten years of the SNTP program.

In the area of chemical safety, the SNTP program would use several liquid and gaseous chemicals to support the program. Hydrogen is classified as a simple asphyxiant; it's greatest hazard is from extremely flammable -- extreme flammability range, which can lead to fires or explosions at

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the site. Oxygen, although not flammable itself, would support or accelerate combustion. Nitrogen and helium are simple asphyxiants; non-reactive, though, as chemicals. Numerous facility designs and handling procedures would be established to ensure that these hazards are minimized when using these chemicals on site. These designs and procedures will be implemented to ensure that the hazards are kept to a minimum. There are no sites specific issues with the SNTS site in terms of chemical safety.

The use of the CTF for testing purposes may allow the build-up of hydrogen inside the facility during operation. Following test completions, venting of the structure would be required before personnel could enter to reduce the potential for explosion.

Several analyses were performed that considered potential impacts from the transportation of radioactive materials.

For the non-accident case of transportation of radioactive materials to the NTS, the calculated total population of those received for the program duration would be 113,000 person-millirems. In addition, only .94 or less than one person-millirems is projected as a result of anticipated traffic accidents. For a non-accident transportation of radioactive materials to the Idaho site, the calculated total population dose for the program duration of

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ten years would be 132,000 person-millirems with an addition of, again, about one person-millirem project as a result of the anticipated transportation accidents.

In all cases, the population dose would be distributed among a large total population, with no member of the public receiving a dose in excess of one millirem, and the majority of exposed individuals would receive a total dose which is immeasurably low.

Beryllium is under consideration for use in the particle bed reactor. Inhalation of beryllium particles may lead to bronchitis, pneumonia, as it is a suspected carcinogen. The only likely release of beryllium would be from a catastrophic failure. However, no credible accident scenario is conceivable that could produce considerable amounts of this chemical. Based on the maximum case release, the total exposure to any individual would be no greater than 3 ten-thousandths of a millirem. The exposure would be more than 50 times less than the Occupational Safety and Health Administration permissible exposure limit of 173 ten-thousandths of a millirem in a 24 hour period. Therefore, we don't see beryllium release as expected to be any significant impact under any circumstances.

I just went through a number of numbers. A lot of information. It's like trying to take a drink out of a fire hydrant, I suppose. It's complicated information. The draft

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is written as simply as we can, but these are technical subjects. But I just wanted to point out in summary some of the impacts I've just mentioned. We've looked at all the different categories for both sites. We expect minor or no environmental impacts in all of the resourcive areas, including the health and safety which we spent an awful long time doing the calculations. The radiological impacts for the normal operations at the non-accident operations is very, very small. You're talking about .6 millirems per year for NTS and 1.35 millirems per year. Put that in comparison if you have a chest x-ray, that's 2 millirems. We flew in here tonight, I probably picked up two millirems myself and I'll pick up two more going back to Texas, and I do this all the time, so -- and your natural radiation background is about 430, on this chart, millirems per year and that varies throughout the country. Here you're at a higher elevation, you probably have more than somebody that's say in New Orleans or on the coast. So it varies and depends on geology and a number of thing. But you would get a dose in the range of 400, 450, 475 millirems per year.

In the accident cases, that was normal operation, so in an accident case, in this case we were assuming that something went wrong with many systems; in fact, all systems. And the reactor had run, we had radioactive materials and we melted down, blew up the entire site, blew up all the hydrogen

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so we got as much radioactive material as we could into the atmosphere. We picked the worst weather conditions, which was an inversion, a very low inversion, and we picked the highest winds possible with the low ceiling directed at the closest population center. So those are the standards we used. And when we did that, the highest doses we would be at NTS is 23.5 millirems and INEL would be 30 millirems. And the standard for an accident, again is the worker exposure is 500 millirems, again compared to the normal background exposure of 430 millirems per year. So those were our summary of the radiologic impact. For normal operations we expect, and an accident scenario we do not expect because it's awful hard to get to that situation. In summary, the EIS thoroughly analyzed biophysical impacts of proposed action, the reasonable alternatives to both sites that are required by NEPA, but the EIS does not address political, economic or fiscal considerations, for these will be judged with the environmental information that we provide during the decision process. At this point now I'll turn the meeting back to Colonel Ruepel. Thank you.

COLONEL HEUPEL: Before we take a break, just two things. One, it's been pointed out when I started I twisted my tongue and commented that we don't have any ashtrays so I asked you not to smoke, and nobody has. I think I said speak instead, so some of you may have caught that. We do encourage

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you to speak if you have comments. Just don't smoke during the meeting. We're going take a 15 minute break, and for some of you who came in later, if you would like to make five-minute comments tonight or anything up to five minutes, you're more than welcome to do that, or if you would like to ask some clarifying questions over the matter that's been presented, you're welcome do that. We ask you to fill out a speaker card which is available at the registration table that you passed by as you came in. So we'll take a 15 minute break at this point.

(A brief recess.)

COLONEL HEUPEL: Ladies and gentlemen, we're going to go ahead and start in. We've got approximately twenty speakers, so I want to make sure we are able to give everybody the opportunity to speak. As we go into this public comment portion of the hearing, I ask you not to be shy or hesitant about making a statement. As I indicated, I want to make sure that everyone that wishes to make a statement or to ask a clarifying question has the opportunity to be heard. We do have a court reporter here with us tonight. She is taking down word for word everything that's said during the hearing. And then this entire hearing record will become a part of the final Environmental Impact Statement and the decision package. So your comments, as well as your questions, the answers, all will be in the final record.

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I ask you to help me follow these ground rules. Now, I'll first announce the name of the first speaker and then the name of the next speaker. While the first speaker is at the podium speaking, I ask the next speaker to come up to the front row. There is a little yellow sheet on the seat that says "reserved speaker," and if you'd go ahead and have a seat there, that way you're up here and can get to the podium more quickly and it helps speed up the process so that, again, everyone has the opportunity to be heard.

The second point is I ask you to speak only after I recognize you, and address your remarks to me. Now, if you do have any written statements you wish to submit, if you'd just go ahead and put them, I believe there should be a basket on the podium, if you've not already put them in a basket.

The third thing would be please speak clearly and slowly. We all tend to start speaking fairly quickly. And state your name and what city you're from and the capacity in which you're speaking. In other words, if you're an elected public official or if you're a representative of a group or if you're speaking as a concerned citizen.

Fourth, I'll recognize each person for five minutes. And we need to impose that limit so that everyone will have an equal opportunity to be heard this evening. Please honor any request I may make for you to stop speaking or to stop asking questions. What I'll do is I'll hold up my hand like this

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when we've gotten to five minutes, and ask you to just go ahead and finish up what you're saying, but don't go too much beyond that. If you have more comments than you'll be able to present in five minutes, prioritize those comments so that you can cover your most important points first.

And fifth, if I call the name of someone who's not in the room, I'll hold the card until the next break and when I call, I'll call the name again and if the speaker is still not present, then I won't call on them to speak after that.

Finally, I just ask the entire audience to be courteous and not to talk while the recognized speaker is speaking. I feel relatively certain we have people representing all spectrums with regard to this project. I would just ask you not to applaud. Frankly, if one side applauds, then the other side wants to applaud when their speaker speaks. And, again, that's just taking more time and I'm most important -- importantly wanting to get your comments rather than having the applause. Your comments are what's most important for us, so that's what we're really seeking.

With that, we have one person that will be speaking on behalf of an elected public official. And while I'm doing that, I'm going to select the card of the next speaker at random. And just a second and I'll be with you. Okay. Yes, ma'am.

UNIDENTIFIED SPEAKER: I wanted to ask if there was

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an opportunity to simply ask questions either for additional information or for clarification?

COLONEL HEUPEL: You may do that. Again, we just ask you to fill out a card, or if you've already done that, that's fine. But fill out a card and I'll call you in the process in a random order. And you're welcome to ask clarifying questions if you have those questions. And if you don't have a card, if you'd like a card, just hold up your hand and we've got somebody back at the backdoor that will get one for you. And once you've filled it out, bring it to me.

Okay, the first speaker tonight will be Mr. Paul Mulder who is representing Congressman Owens. Following him will be Leuretta Wilson. Mr. Mulder.

MR. PAUL MULDER: Thank you. My name is Paul Mulder. And I'm a representative of Congressman Owens. I'm here to read a prepared statement. I commend the Air Force for following through on its pledge to me at the first of this year to more fully involve the people of Utah in this important public policy matter. We saw evidence of the importance that my fellow Utahns assigned to this issue in your hearing earlier this month in St. George where 200 concerned citizens came to share their views with you and those views were not altogether positive. Utahns know all too well the angers and heartbreak associated with nuclear testing in Nevada.

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And when I spoke last spring here in Salt Lake City at the scoping hearings for this Draft Environmental Impact Statement, I expressed two fundamental concerns. However, one of my concerns, that of the environmental impact of nuclear rocket testing, has now been addressed in more detail in your draft EIS. Experts with whom I have spoken have concluded that testing within the parameters described in your draft EIS could be relatively safe. It would appear that if, in fact, a decision is reached to proceed with this program, there are
1 adequate measures being considered to ensure safe operation. But the rationale for the program requested by me in your
2.1 earlier hearing is still not addressed in this document. There is nothing but a general description of the uses to which a nuclear rocket would be put and, in short, no justification for this program.

The Air Force, in fact, has ignored a directive from our House Arms Services Committee to provide a detailed basis for this program. Understandably, the committee is refusing to authorize expenditures for the SNTP. This situation is something of a mystery since the Air Force has simply been requested to describe why it has to spend hundreds of millions
2 of dollars and how it would use a nuclear rocket. For instance, if such a rocket has applications for interplanetary
1.20 space flight, why isn't the National Aeronautics and Space Administration the lead agency in the effort?

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The Senate has only allocated ten million for research of nuclear rocket technology, but for the same reasons as those expressed by the House, no development money is authorized. Further raising doubts about the program, the Air Force itself has not included the SNTP in its long-term budget planning document. This does not give me much confidence. However, in an all too familiar pattern, some $123 million has been earmarked for the SNTP by friends of the program and the House Appropriations Committee. This is an all too familiar scenario.

I am currently waging a fight to kill funding for the advanced solid rocket motor program. A program, that is aside from not being needed, is over budget and behind schedule. I have successfully killed it in the House, but it does, however, have friends in high places. Reports have it that the house senate conferees meeting in a few weeks plan to put money back into the House and the Senate decided to take it out. This plan is being implemented by those who feel that despite the billions of dollars being wasted, jobs in their state should be considered first.

3 2.2 The executive summary of this Draft EIS states that this nuclear rocket technology would enable a broad range of missions that other rockets could not undertake. I asked the Air Force to name one. If even NASA indicates that the design put forth by the Air Force is unsuitable, I believe that until

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there is adequate explanation of how a nuclear rocket woul! be used and by whom, there should be no funding for tests. It's time for the Air Force to come clean. As it stands, this draft EIS indicates a small risk for nuclear rocket testing, but an even smaller benefit for mankind. I certainly cannot, and will not, support this program as it is currently presented. This is a throwback to the days when the Defense Department didn't feel it had to explain to the public any but the most rudimentary aspect of programs it favored. This nuclear rocket program in effect is a missing link to the past that cannot and will not be tolerated, without an adequate reason. It's too much to ask Utahns to take even small risks with nuclear testing. Thank you.

COLONEL HEUPEL: Thank you. After Ms. Wilson will be Brian Meacham. Meacham or Meacham, I'm not sure.

MR. BRIAN E. MEACHAM: Meacham, that's fine.

COLONEL HEUPEL: Meacham, okay. Ms. Wilson.

4 9.1 MS. LEURETTA W. WILSON: The statement in this Draft Environmental Impact covering the acceptability of the Nevada test site included the observation that the site is owned by the U.S. government. The Nevada test site occupies a portion of the Western Shoshoni Nation. Land guaranteed by the treaty of Ruby Valley, signed in 1863 by President Ulysses S. Grant. That the U.S. Government took the land for the test site does not make it government owned land since this was done without

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4 cont. 9.1 the approval of the Western Shoshoni Nation.

COLONEL HEUPEL: Thank you. After Mr. Meacham will be Richard Kenney. Mr. Meacham.

MR. BRIAN E. MEACHAM: My name is Brian Meacham. I am here as a spokesperson for a group called Utah Peace Test. I have a statement to read. Utah Peace Test is a group of citizens actively engaged in nonviolent direct action to end the development and deployment of nuclear weapons. We are uniquely characterized by our ability to make decisions through consensus by our commitment to nonviolence and by our principles of openness and honesty.

A 13.4 Upon reviewing the draft EIS for the Space Nuclear Thermal Propulsion Project, we strongly recommend that the no-action alternative be taken by the Air Force for the following reasons: Last night CBS news reported that the national debt is currently four trillion thirty-five billion dollars and climbing at a rate of $13,000 a second. The average share of each person in the country is currently $16,270. This deficit is largely due to military spending over the last twelve years. We taxpayers are tired of the federal government practicing deficit spending. We feel that this project should not continue. That the government should pay its bills and budget money in advance for these types of research projects.

Our second objection to this project is the obvious

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military weapons capabilities that such technology would provide. Currently the government is continuing to waste our money on strategic defense initiative. If this particular project proceeds, we have no doubt that it will eventually be used to deploy weapons in orbit around the earth. We hold that such action would be in violation of international treaties prohibiting demilitarization of space which the United States Government is legally bound to uphold. We recommend that this project not proceed until the military is prohibited from using this technology to deploy weapons in space.

Our final reason why the Air Force should choose the no-action alternative is that this draft EIS indicates that the Department of Energy will be involved in the management of the project and will oversee safety procedures and reports. Gentlemen, it may not have occurred to you, but the Department of Energy has the worst safety record of any federal agency. A government accounting office report issued a few years ago indicated that there were serious environmental contamination problems at all of the plants that are a part of the nuclear weapons complex. Also, the F.B.I. raided the offices at one particular facility, that at Rocky Flats, in an attempt to confiscate agency records. And documents indicated gross negligence and the cover-up of hazardous and radioactive waste released into the environment in violation of EPA regulations.

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They determined that such pollution had been going on for
decades.
The Department of Energy also has lied to the
American people about radioactive venting of underground
tests. In one such case people living in a small trailer park
were dusted with radioactive fallout. We do not trust, nor
believe that the DOE is capable of honestly and correctly
monitoring the safety aspects of this project.
However, if our piece of the truth fails to
influence the Air Force, we find that the Saddle Mountain test
8 site in Nevada is unacceptable for these reasons: First and
foremost, we know and hereby testify that the Nevada nuclear
test site is the land of the Western Shoshoni Indian Nation.
9.1 We find that the DOE is, and the Air Force would be, illegally
occupying sacred Indian land unless and until they receive
permission from the Western Shoshoni National Council. We
utterly disagree with the EIS finding that there would be no
8 adverse impact in resources at this site. To the Shoshoni,
all things on this earth are sacred. Saddle Mountain itself
is a sacred special tribal place. These facts are well
9.2 supported by the findings of the Indian Claims Commission
hearings which examined expert testimony about the historical,
7 cultural and tribal use of Shoshoni Indians. The EIS is in
9.3 error since there is no documentation that the Western
Shoshoni National Council was consulted or of any of the

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7 cont. 9.3 evidence that was presented by the Indian Claims Commission.
8 Our second reason is that we know from experience
that the desert ecology at the test site is fragile. Members
of Utah Peace Test have camped and have lived on the desert at
different times for more than four years. We know it barely
8.1 rains there. We know how cold it gets. We know that there
are many species of plants that are fragile to existence. We
believe that any impact on the scale of a hundred acres would
be detrimental to the desert environment and such impact would
be difficult to mitigate and remediate. Thank you very much.
COLONEL NEUPEL: Thank you. After Mr. Kenney will
be Mary Stevens. Mr. Kenney.
MR. RICHARD A. KENNEY: Good evening. I'm Dick
Kenney speaking as a concerned individual. I am a native of
Salt Lake City, I was raised here, attended the University of
8 Utah. And recently have moved to Idaho Falls. And I wish to
13.1 express my support for the establishment of this project in
the -- at the INL. I do this basically for three reasons.
One is just becoming familiar with the people that are there
and the talent, the training and the skills and the experience
of the people that are available to work on the project. They
are backed up by almost a dozen universities that cover the
I-15 corridor and provide skilled and talented products on an
annual basis that would continue to support this kind of a
project.

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Secondly, I feel like it would really enhance an industry, the aerospace-type industry that has been growing here in this area for sometime with the work of Hercules and Thiokol, the Space Initiative at the Utah State University, and the several projects that have been completed at INL.

Thirdly, the infrastructure that's there and the record of success that they've had in safety and in maintaining the ecology and bringing projects in on time and in budget.

For these reasons, I firmly support the establishment of this program at INL and suggest that we not spend an awful lot of time thinking of the hate and fear mongers who would have the delay of any advancement in science, and I say this. Thank you.

COLONEL NEUPEL: Thank you. Is Mary Stevens here? Yes, she's right there. Okay. After Ms. Stevens will be Walter Wagner. Yes, ma'am.

MS. MARY STEVENS: I merely have a question for clarification. Perhaps Colonel Baumgartel could answer it. This is an Air Force project and the possible effects of it have been assessed in an independent EIS, carried on by the Air Force?

LT. COLONEL BAUMGARTEL: I can answer that. That is correct. What we do at the center, we work for the Pentagon at that level where the execution element for environmental

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impact analysis process for the chief of the staff of the Air Force. We look at different proposals from different programs throughout the Air Force. In this case it's coming out of Phillips Lab. We have no connection with the Phillips lab. We do do that. Our job is just looking at the environmental. My staff is fully -- it's all environmentalists. And we use contractors from around the country with us to augment our staff. And we do a fair job at doing that. And that's why we were developed specifically for that. And it's one of the key goals in the Air Force today that we are light years ahead of other federal activities in the environmental area. And that's on that basis and our program. So, yes, it is an independent analysis. The facts, they're there, they're supportable, there's all the backup information for them.

COLONEL NEUPEL: After Mr. Wagner will be Richard Lawrence. Mr. Wagner.

MR. WALTER WAGNER: Yeah, hi. I'm Walter Wagner. I'm from Honolulu, Hawaii. I'm a long-term visitor here in Utah. A number of the previous speakers have addressed issues that I didn't believe were supposed to be addressed here in terms of the fiscal impacts of the project, so I'm not going to comment on those.

I'd like the Air Force to cover certain environmental aspects of this which I believe are probably already addressed but I don't think were adequately commented

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9 on here. I'd like to insure that -- or the Air Force to insure that the coatings, there's carbide or other type
12.11 coating around the -- so the U-235 maintains its integrity. That you do a very good testing program on that so that if it doesn't maintain its integrity, you have a zero release of
10 fission products during the testing program. I'd like you to insure the effluent stream is adequately monitored for radio isotope releases and that you have a feedback mechanism that if any radio isotope releases are in fact detected, that the
12.18 reactor is immediately shut down. And I would also like you to insure that the air quality is monitored throughout the test site as well as at the perimeter of the test site to make certain that you have a very good handle on what kind of releases might have accidentally been made. And I'd like to hope that you can do this in about four or five years rather than the ten years you've projected, thank you.

COLONEL NEUPEL: Thank you. Colonel Bleeker, let me ask you if you could perhaps address the first point that Mr. Wagner raised, which was can you give some idea of what testing has been done with regard to the particles?

LT. COLONEL BLEEKER: All right. The program has been going on for about four years. We talked about Environmental Impact statements that -- is that mike on? That has been going on for two years. And there's been significant amount of testing already been done and, in fact, a fair

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amount of money, 175 million. And work has been done heavily on those fuel particles so we know that we can heat these fuel particles, we know that we can heat them in a nuclear reactor and those coatings last. We'll be doing additional testing at even higher power levels before we even think of taking it out to a large facility out either in Nevada or Idaho. So it's certainly a step-wise program. We need to make sure since, as you pointed out, the fuels, the coatings on the fuel are a key element in the design. The effluent stream we may have mentioned during the briefing, if we didn't we certainly intend to monitor what's coming out of that exhaust system. And the idea is if there's any trace of release, immediately shut down the test and that basically stops anything else from coming out. And I think there was a third question and I --

LT. COLONEL BAUMGARTEL: The monitoring system.

MR. LEPPERT: With respect to the monitoring, the Nevada test site has a fairly extensive on-site and off-site monitoring system for releases and they're tied in. In fact, there's a community monitoring station right here in the city of Salt Lake City.

LT. COLONEL BAUMGARTEL: They're the same.

MR. LEPPERT: Yeah.

LT. COLONEL BAUMGARTEL: I just wanted to say it's the same for the INEL, he just happens to be speak for the Nevada test site. It's the same for each.

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COLONEL NEUPEL: Were you able to understand that? What Colonel Baumgartel was saying, it's the same for INEL. Mr. Leppert is from Nevada and is aware of that site and Colonel Baumgartel was speaking to the -- it applies to INEL as well, that there is the monitoring. Okay. After Mr. Lawrence will be Lynne Motola. Mr. Lawrence.

MR. RICHARD LAWRENCE: I'm going to finish the statement for the UPT.

COLONEL NEUPEL: If you could -- yeah.

MR. RICHARD LAWRENCE: I'm going to finish the statement for the Utah Peace Test.

COLONEL NEUPEL: Okay.

11 MR. RICHARD LAWRENCE: Our final reason that we fear the chosen site is that it's too close to the location where underground nuclear testing occurs. We do not believe it is
10.2 smart to build an extensive test facility in an area where the geology experiences shock waves on the magnitude of 4.5 to 6 on the Richter scale every time a weapons test is conducted. And I'd like to add perhaps that's completely -- that that's over with because I think we've stopped that nonsense.

Our final comment on the Draft EIS is about the proposed technology research itself. We'd like to recommend to add the ideas to add to the program if the program does go
12 forward. First we recommend that the radioactive monitors be
12.18 placed in the effluent treatment system so that complete

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12 cont. routine inspections be done after every test to quantify how radioactive the effluent is. And we also recommend that
12.18 radioactive monitor stations be placed outside near the site so as to act as an independent check that no radioactive material escapes into the environment. And also I might add you might have quality control with that independent -- with that monitoring since the OSHA found -- OSHA Tigers Team found that they were not having quality control at the nuclear weapons test Nevada. That's a digression, but I wanted to add that.

13 We also are disappointed that the EIS does not address the possibility of using alternative propellant methods, such as the solid rocket motors that Hercules
1.4 produces for the Trident II missile system. In fact, we suggest that if you want to throw up satellites, you should contact the Navy and get all their Trident missiles and replace the warheads with your satellites.

14 Finally some advice. Be open and honest about this project. Let us know when there is an accident. Give us the
12.50 safety reports and show us what level of radioactivity is in the effluent. And let us know what damage there is to the reactor when it is tested. Thank you.

COLONEL NEUPEL: Thank you. After Ms., is it Motola?

MS. LYNNE MOTOLA: Yes.

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COLONEL NEUPEL: Okay. I'm sorry. It will be. I believe it's David Martyn. It's either David Martyn or Martyn David.

COLONEL NEUPEL: Yes, ma'am.

MS. LYNNE MOTOLA: I'm Lynne Motola. I'm from Salt Lake. I have family in Idaho and people that I love downwind in St. George. When I came in tonight I didn't know anything about this. My friend invited me to come and I've tried hard to listen. I don't have a scientific mind. I have some questions just based on what I've heard tonight. Colonel Baumgartel, and I've written this, I hope you'll bear with me. I wrote my questions so I wouldn't lose it as I got up here. In describing this system, you've used words like too early in the system to know, speculative, theoretical, and you've said that there is no known or projected application of beneficial technology to the private sector. Given that the United States, as evidenced by the closing and/or severe cutbacks in operation of most of our early warning radar facilities on this continent is currently in a decreasing defense posture, if we have no idea or projected idea how this new system could benefit humanity, and if it is not likely to be used for the 16 21 defense of this country, why exactly do we need this? I'm the mother of five little kids and I want you or one of you to tell me honestly what's the worst case scenario on this thing? If I don't -- I don't understand. I'm just a mommy. If I

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don't understand why we need this, and Wayne Owens' representative said that Wayne Owens said that for him this rationale for this expenditure of hundreds of millions of dollars is unexplained. Convince me, and I want to know the truth. You owe it to me and you owe it to my kids. Why do we need this? What is this for?

COLONEL NEUPEL: Well, we're not here to convince. What we are here for is to collect comments that people have on the Draft Environmental Impact Statement. If you'll recall what Colonel Baumgartel pointed out earlier that there's in essence two aspects to this. One aspect is trying to get all the comments and look at all the environmental impacts. That's part of the decision making process. The other aspect that you talked about, is the need sufficiently there? How does that counter balance with cost? Those are decisions independent of this environmental aspect. Those are still decisions that are going to have to be made by not only the Department of Defense, but by Congress. Those are areas that we're not getting into in this hearing because this hearing is strictly looking into the environmental impact. So to convince you there is a need, that's a determination that each person is going to have to make and the Department of Defense is going to have to make. And if they decide there is such a need, Congress is going to have to make -- now, on the other hand, you also asked a question about I believe going back to

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worst case scenario. And Colonel Baumgartel, I believe you can talk to that.

LT. COLONEL BAUMGARTEL: Let me just clarify what I did say on the same subject you were just talking about. Colonel. When you're looking at applications of technology that doesn't exist, I said it gets very speculative. If it works and turns out to be a good technology, then there are applications, potential applications for this that would be very cost effective. Now someone mentioned Trident rockets or something. This is a cost saving thing also. So what we're saying is that at this point we have a technology that's not proven, it doesn't exist, the transistor doesn't exist. It's awfully hard for us to figure out, like I said, how we're going to construct the transistor radio. So it's the same thing. The component is not there. We just don't have that technology. So this is a pure technology decision of whether or not it's important for investment of funds and that's going to be taken care of at the level of the decision makers, the elected officials, and a higher level than this. At this point in time the needs point is technology for all potential applications and it's aimed toward space, although there are some others.

Now the second part of that question was the impact. What is the risk? The numbers I threw up there, and I thought I gave you the right numbers. Generally each year you receive

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say 400 millirems of radiation by living on the planet and being exposed to normal hazard. Okay, if you have your teeth x-rayed or those kinds of things over your lifetime, they'd average out around 400 millirems. Living at a higher elevation here, you've added quite a few millirems just because you're at a higher elevation than a person who lived in say New Orleans on the coastline. If you live in Nevada, there may be more uranium deposits in Nevada than there are in Massachusetts and you may have added more there. I don't know, I don't have all the numbers, it varies. But you're subjected to around 400 millirems. So we're saying in this case normal operations you are talking about one-half of the millirem annual dose, you know, added to the 430 or whatever at one site and the other site I think it was 1.3 or something like that added to it. We're saying if we ignored all safeguard measures which are there and just say we're going to blow it up and just test it under conditions that are not and just shut it down and not have the test during conversions and high winds and there's a number of categories they go through when they wouldn't do it, we say forget all that make, the worst say case accident and blow it towards somebody, the pulse of the population, and in doing that we only came up with a total dose of around 20 to 30 millirems, depending on each site. Again, put that in comparison and you're going to get 400 millirems a year, part of that is natural background.

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part of it is fallout from prior tests. A very small portion, maybe six millirems, so you have to make your own decision. My feeling it's within that range of being safe. So that's what I say.

COLONEL HEUPEL: After Mr. Martyn will be someone representing the Jack Otto family. Mr. Martyn.

MR. DAVID MARTYN: My name is David Martyn. I live in Salt Lake City. I have two comments about the environmental health hazards associated with this project, and one question. 18 First of all, I thought it should be pointed out that it is the consensus in the scientific community that there is no threshold level below which exposure to ionizing radiation can be said to be safe. So that comparisons of the increased doses that we will be exposed to in connection with 18.51 this test series with the exposures to natural radiation overlooks the fact that also the exposure to natural radiation is a health hazard. Instead of portraying your project as something which is completely safe, you should be honest about the fact that we are talking about something that puts people at risk. When you do that, it becomes clear that the decision we have to make is one of comparing risks. Which risk seems more real to us, the risk of the health hazard because of the exposure to radiation or the possibility of a military threat which could be overcome by this project of yours? I think that in view of the history of nuclear testing at the Nevada

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test site, the risk, the environmental health hazard risk is substantially more real than any scenario of a military situation which would necessitate this system. It has been proven in epidemiological studies that testing at the Nevada test site caused leukemia in children and caused them to die.

17 1.15 I find it, that brings me to my second point. I find it very surprising and upsetting that there was no mention made here of the history of nuclear testing at the Nevada test site. I thought the parallels that are obviously present between what you are now planning with what happened then. For example, the fact that we have here a government agency which claims to be independently regulating itself. That is a logical nonsense.

That brings me, I guess, to my question. During the atmospheric testing at the Nevada test site in the 50's and early 60's, the people conducting those tests which are by and large the same agencies, the Atomic Energy Commission, the Department of Energy, which will be involved in these tests, waited to find out what direction the wind was blowing before 18 3.7 they made their tests. My question is, are you planning on waiting until the wind blows in our direction before you make your tests with this missile? Thank you. That was a question.

MR. LEPPERT: Well, at testing at the Nevada test site, you know there's a lot of factors, as Colonel Baumgartel

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said, in the whole testing program. The wind direction is one, wind speed is another, the inversion layer, all these would be factored into a test program. So that one direction or another, it's not we wait for a certain direction, it's a combination of factors from a meteorological standpoint that we determine when a test would be conducted and the stability of that forecast over a given period of time.

COLONEL HEUPEL: Okay, Mr. Otto. And after Mr. Otto will be Boyer Jarvis.

MR. JACK OTTO: Thank you. I have a couple of questions. First of all, I'm not sure if I understood right the -- this is for Lieutenant Colonel Bleeker. Am I correct -- first I'll just ask the questions. Am I correct in my understanding that there would be no introduction of oxygen, either preheated before it goes to the nozzle or at any time in the future is this not planned in any --

COLONEL BLEEKER: None of the designs have anything to do with oxygen.

MR. JACK OTTO: There's no oxygen introduction to the plasma at all.

COLONEL BLEEKER: No, it's pure hydrogen.

19 3.8 MR. JACK OTTO: Okay, great. And the other question I have for Colonel Baumgartel. You mentioned that there will be a transportation of uranium 235 by road. Will this go through the State of Utah? Where will it come from? Where

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19 cont. 3.8 will it go to? How often could we expect to have nuclear materials traveling our highways, and in what kind of frequency and how large of amounts?

LT. COLONEL BAUMGARTEL: One of the appendix, I think it's appendix E, it goes through the modeling of the transportation, non-accident and what kind of radiation, it covers all the loads, how much could be transported on each truck, how they're packed, what kind of vehicles and where they're coming from and where they would go to. Whether it was the materials coming to the site or wastes being transported to other facilities, so that's all in there. I don't have it in in front of me, that's what I'm saying, but it's there if you want to look at it. It's a very small portion of, again, with the risk factors we're down, I think it was like one millirem or below for the lifetime of the project, very, very small, small potential.

19 cont. 3.8 MR. JACK OTTO: Okay, well, I think our main concern is accidents on the highway.

LT. COLONEL BAUMGARTEL: That was even smaller. And I'll have to defer to one of the folks that work with nuclear all the time, but the transport vehicles they use are very safe and they've tested them -- they meet severe accident standards including being hit by a train and not breaking open. And I mean it's very high on the safety risk factors and they keep the quantities at a very small amount.

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MR. JACK OTTO: Thank you, sir. Sir, I'd like to say that as a citizen, I'd like to commend the Air Force for holding these public hearings. I think it's important. We have a very long memory when we do get lied to or if the facts are misrepresented. I'd like the Air Force and the DOE to remember that. And we hold you accountable for all that you say and for all that you do, the people of our state and our country. Thank you.

COLONEL NEUPEL: Thank you. After Mr. Jarvis will be Diana Hirsh -- Hirschi, excuse me. Mr. Jarvis.

MR. BOYER JARVIS: My name is Boyer Jarvis. I live in Salt Lake City. I'm speaking as a concerned citizen. I would like to begin my comment by letting you know that the statement that you heard read by Congressman Owens' representative this evening needs to be taken very, very seriously. He speaks not just for himself. He speaks for thousands of his constituents. So I urge you not to disregard what you have heard from Congressman Owens this evening. Also I would like to point out that the question asked by David Martyn, if this program is established at the Nevada test site, will you wait until the wind is blowing our way before you test, that question was not answered categorically, it was obfuscated. Now I would like to ask a couple of questions myself. I understand from this presentation that the first decision to be made is whether or not this program will go

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forward. And that that decision is to be made by the assistant secretary of the Air Force. Do I have my facts straight on that procedure?

COLONEL BLEEKER: That's what it says on the chart. It may actually be at a higher level than that as far as whether, you know, the program continues or not.

COLONEL NEUPEL: Can you explain that a little more?

COLONEL BLEEKER: Well, I'll try to answer it, but it may be up to the secretary of the Air Force or even, for instance, the deputy secretary of the defense.

MR. BOYER JARVIS: Then you're not really able to tell us what we need to know; is that correct?

COLONEL NEUPEL: What do you mean by that?

MR. BOYER JARVIS: I need to know -- I am asking you to tell me who is going to make the decision whether or not this program will be continued or not continued?

LT. COLONEL BAUMGARTEL: I can explain summarily. You know, they're not independent decisions by the executive branch and the Congress. The Congress funds the programs, the Air Force, which is part of the Department of Defense, through their budgeting program goes -- feeds its information to the President's budget which in presenting to the Congress they line item by line item go through that. So if the decision makers say in the Air Force side decides that it's a good idea to press with this, it still has to make it through the

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appropriations side.

COLONEL BLEEKER: There's a lot of people that can kill it.

LT. COLONEL BAUMGARTEL: There's more than one decision maker, that's what I'm saying.

MR. BOYER JARVIS: What I'm hearing from you now then is that you assume that this matter will be presented to the Congress for funding?

LT. COLONEL BAUMGARTEL: We don't assume anything. We didn't say that.

MR. BOYER JARVIS: Well, then I'm going back to ask you the question.

LT. COLONEL BAUMGARTEL: We have answered that.

MR. BOYER JARVIS: Who in the administration -- who in the administration will decide whether or not this project will be presented to the Congress for funding?

COLONEL NEUPEL: Okay, all we can tell you is the minimal approval level. The minimum possible approval level would be the assistant secretary for the Air Force for acquisition. It might be made higher than that, we do not have any information as to whether that could be withheld and made at a higher level. That is the lowest level individual that could make the decision acting for the secretary of the Air Force.

MR. BOYER JARVIS: All right.

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LT. COLONEL BAUMGARTEL: The individual that makes the decision on the executive side will have his name signature on the record of decision which will be published in the federal registry. And that will happen after we complete the EIS at some point, whenever they --

MR. BOYER JARVIS: Your presentation this evening says that the decision is to be made by the assistant secretary of the Air Force. So I want to ask you how do I address the assistant secretary of the Air Force? Do I address the assistant secretary of the Air Force by sending a comment to Captain Hardford at the Brooks Air Force Base or do I address the assistant secretary of the Air Force directly?

LT. COLONEL BAUMGARTEL: You can address him directly, that's your choice.

COLONEL NEUPEL: Well, if your comment is as goes to the program's environmental aspects, whether or not it should be done, you can send that to Captain Hardford, it will become a part of the EIS. On the other hand, if you choose to write directly to the assistant secretary, that's something that's certainly within your purview.

MR. BOYER JARVIS: That's the assistant secretary of the Air Force for acquisition?

COLONEL NEUPEL: For acquisitions at the Pentagon.

MR. BOYER JARVIS: Thank you.

COLONEL NEUPEL: Yes, sir. After Ms. Hirschi will

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be Cherry Wong. Yes, ma'am.

MS. DIANA LEE HIRSCHI: I'm going to say a few things tonight that haven't been brought up. I think that human beings and the way we interact with each other is definitely a part of our environment and that's what I'm going to address. I would like you gentlemen to look at each other. Look at each other. Look at each other. Look at each other. What -- tell me, what do you see? I'll tell you what I see. I see white men in uniforms, the most powerful military nation on this earth making decisions that are going to affect the lives of other people. And I'll tell you what else I see. I see a culture, this culture, that is functioning today as a practicing addict. We are addicted to wealth and power. And right now this project is another expression of that addiction. What you've presented to us tonight I think was logical and rational and totally insane. It is crazy. It borders on bizarre. And I think that it's time that we started telling the truth to each other. I'm telling you the truth that I feel inside. I think you are lying to yourselves. I think you are lying to us. And I don't mean that as a criticism, because that's a symptom of addiction. It's very hard to be honest. It's very hard to tell the truth.

Now, once before a group of white men got together and they decided to do a little project in total secret. Now

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that little project gave birth on July 16th, 1945 in a test called Trinity to the nuclear age. And it has been hell on earth ever since. In less than a month after Trinity, we dropped a bomb on Hiroshima killing over a 100,000 people and people's faces melted off their bodies. People were vaporized and left shadows on the ground. And I was three years old at that time.

Today I filed the papers, the last round of papers in a compensation claim for the death of my father. And I don't very often speak of this in public. My father died as a result of testing at the Nevada test site. I grew up downwind, we were told it was safe. We were told that over and over again. Now the government has admitted that it lied. That's the important part of the compensation bill, the apology by the government. So with all due respect to you, because I care about you and I respect you as human beings, I would like to formally and in public call you on your bull-shit. Thank you.

COLONEL NEUPEL: Thank you. After Cherry Wong will be, I believe it's Leo Fife.

MS. CHERRY WONG: I'm Cherry Wong from Salt Lake City. And I'm a member of the board of the Utahns United Against the Nuclear Arms race, which is a large and diverse

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group of informed citizens. Our objection is to the proposed action itself. That is to developing a PBR technology or any

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facility that continues the development of nuclear thermal propulsion technology. Nuclear thermal propulsion systems that may eventually pollute the atmosphere and space when they are tested or used are a crime against humanity and should be discontinued. I know this is only the first stage toward another stage where such a technology may be used in the atmosphere. This program also is very expensive and it should

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be halted with the conclusion of these hearings. I assert that there is no need for this program.

COLONEL NEUPEL: Thank you. Is Leo Fife here? After Mr. Fife will be Dr. Guemple, I believe. If I'm close on the pronunciation.

MR. SCOTT FIFE: Okay, my name is Scott Fife and I'm a Global resident.

COLONEL NEUPEL: Sorry on the name.

MR. SCOTT FIFE: That's okay, no problem. Okay, well, somebody spoke about fear mongers, you know, and I don't have to look very far back to see, you know, what brings about this fear, you know. We want to use this propulsion system to power rockets into space. We just need to look at the Challenger and the test site. Now people tell us after the fact that we've been poisoned. You know, that doesn't do us a

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lot of good. I want to say that I support the no-action alternative. The military's record on lying is just as recently as the Gulf War. The citizens of the west have been

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used as guinea pigs. Now, just by this -- the 200 citizens that I've heard that came out of St. George and the majority of them were against this idea, that tells me a lot. $123 billion, that seems like a complete waste. Up in Idaho right now with there nuclear storage facility it's becoming really dangerously close to one of the biggest aquifers. Down in Nevada just in, I think it was in May, they had a big earthquake and they've now abandoned ideas for storing nuclear

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waste there because of the earthquake. And the Nevada land also belongs to the Shoshoni Nation. I think we should think about that.

The fact of NASA not getting involved themselves, that makes me question the fact if this military technology is needed, and it's going to be definitely military and what prevents this, just like the Star Wars, from being turned on to our own citizens? Thank you.

COLONEL NEUPEL: Thank you. Am I anywhere close to right?

DR. GUEMPLE: You're very close.

COLONEL NEUPEL: Okay.

DR. GUEMPLE: Similar names.

COLONEL NEUPEL: After you, ma'am, will be Ira Koplow.

DR. GUEMPLE: I'm Dr. Guemple. I'm the CEO of Eastern Idaho Technical College in Idaho Falls. And I have a

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prepared statement. Eastern Idaho Technical College E 13.1 encourages your support to locate the space nuclear program at the Idaho National Engineering Lab. The INEL was established in 1949 to demonstrate the safe use of nuclear energy. And since that time, a wide variety of both nuclear and non-nuclear research and development programs have been conducted at the INEL. A majority of these projects have resulted in tremendous benefit to the entire nation.

As a director of Eastern Idaho Technical College, I pledge the college's willingness to work with the INEL in developing the necessary technician level training programs needed to support the space nuclear program. Since 1949, we have worked very closely with the INEL and have created many one of a kind, many only one in the State region highly sophisticated training programs for the INEL such as radiation safety technician, chemistry lab technicians, quality assurance, nondestructive testing, hazardous materials technicians, and nuclear security training. In addition to the highly skilled technician level employees for the INEL, I-Tech provides all radiation respirator worker training for construction workers employed at the INEL. Last year I-Tech trained over 500 construction workers employed by small contractors to do work at the INEL. For residents who need additional assistance, such as basic skills, high school equivalency and training in math and general sciences, I-Tech

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also plays an important role. I-Tech offers a regional adult learning center staffed by professionals to expand and enhance academic skills of adults located throughout southeastern Idaho. Without such a program, many of the technician level positions which require highly sophisticated training would go unfilled or filled by residents from outside the area. In my position, I see a great impact the INEL plays in this community. The fantastic lifestyle enjoyed by residents of Idaho Falls, Bonneville County and the surrounding region is due in a large part to the INEL. This relatively small community provides residents with access to an excellent elementary and secondary education system and a rapidly growing system of higher education provided by two universities and Eastern Idaho Technical College. A primary recommendation of a local economic diversification group which was recently established in the city of Idaho Falls is to not only gain a greater understanding of technology transfer, but how to assist existing businesses and industries in expanding its economic base. I view the space nuclear program as a prime example of economic diversification. The 100 construction workers and 40 permanent positions required to staff the space nuclear program will be an excellent start toward economic development and diversification in this area. Each year we train hundreds of local residents for potential employment at the INEL. As a result of our training, students

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secure good jobs, good careers at the INEL and we see dramatic changes in their lifestyle and their incomes. I believe that the nuclear space program will go a long ways in positively changing many more lives in the future and again I support the space nuclear program and encourage your support to locate this technology at the INEL. Thank you.

COLONEL HEUPEL: Thank you. After Mr. Koplow will be Elise Lazar.

MR. IRA KOPLOW: Name is Ira Koplow, I'm the executive director of the Greater Idaho Falls Chamber of Commerce. On behalf of the Ira Koplow family, along with F 13.1 several Chamber of Commerce members to testify in support of continuing the space nuclear thermal propulsion program and of locating the validation test facility at the Idaho National Engineering Laboratory near Idaho Falls, Idaho. The INEL location has broad public business, civic, local government, state legislature, and federal congressional delegation support along with the governor of Idaho.

The INEL is qualified to handle this test program because of the experienced staff and their exceptionally strong safety record in conducting testing. The INEL has the properly contained facility in which to conduct the testing, along with other support facilities necessary to analyze tested articles. In addition, the INEL has the infrastructure to support all of this activity. We recognize the importance

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of continued leadership in space exploration from the United States Air Force. In addition to experiencing the confidence we have in the people that work at the Idaho National Engineering Laboratory, we believe the most important asset we can offer the U.S. Air Force is the experience and enthusiasm in the people that will make the testing program happen on schedule and within budget. INEL has done this on several other Air Force projects. Our community, our region and our state appreciate the efforts of employees working at the Idaho National Engineering Laboratory.

The INEL is a leader internationally in nuclear research. The city of Idaho Falls and Bonneville County leadership have positioned our city and county for growth. Our power, water, waste disposal infrastructure, and educational system are in place to support additional business and population growth.

Idaho and Utah are closely aligned in several respects. We have family ties, commercial, recreational, and educational ties. We want to solicit the support of Utahns in locating the test site at the Idaho National Engineering Laboratory. INEL has a record of safe reactor testing. INEL has a containment facility as an extra safety measure. We believe this could mean even closer ties with the space technology programs at several Utah universities.

We greeted you last April in Idaho Falls with well

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over 1000 supporters. We're here in Salt Lake City to remind you of our support. We're looking forward to greeting you on September 17th in Idaho Falls again with several hundred supporters to make sure you understand our desire and our support.

We are confident that the Air Force will conclude technically that the INEL is the best location because of the people and the facilities. Along with it being the safest location and that the community supports the program. We look forward to welcoming many new Air Force personnel to our community. Thank you for this opportunity to testify.

COLONEL NEUPEL: Thank you. After Miss Lazar will be C. E. White, Jr.

MS. ELISE LAZAR: I have a couple of questions and then a very brief statement. My questions had to do with cost. And I want to understand why it is that you cannot provide the information as to exactly what this will indeed cost?

COLONEL BLEEKER: You're looking for the cost of the facility?

MS. ELISE LAZAR: Yes, uh-huh, or for the entire program.

COLONEL BLEEKER: In order to get through the ground testing part, the part that we described tonight, it's approximately $800 million. The facility itself is around 400

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million. If somebody made a decision at that time after a successful ground testing to make an engine that could be flight ready, you're talking conceivably another $800 million.

MS. LAZAR: Thank you. Also I wanted to know what the cost was for the analysis of the environmental impact? What has been spent thus far?

COLONEL BLEEKER: There was approximately a million dollars spent by SDIO on the previous environmental impact statement and there was probably another 800,000 to a million spent by the Air Force in going through the process and the documents you see today and the analysis. Probably $2 million all total.

MS. ELISE LAZAR: All right, thank you. I wanted in my statement to allude to a situation that we all remember all too well. And that is the Rodney King case in Los Angeles. This was a case where a man had been videotaped being beaten up by officers. There was a trial and the officers were found not guilty, much to the surprise or even shock of many people in the United States, including, of course, the black community in Los Angeles. I remember reading and hearing some analyses of exactly how that could have happened when it was so clearly defined on the tape that he had been beaten. And one of them which really was very interesting was that in the courtroom, the lawyer had been very smart and had taken apart the tape and had freeze framed so that he went through each

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frame and assigned the action in each frame a very benign reason. He gave a benign explanation for each freeze frame so that the jurors didn't look at the total picture.

What I see here is an example of that same sort of thing. You have given a very precise and logical explanation of one freeze-frame, but I think we should look at the whole picture. I think that we need to look at the ultimate cost. I'm astonished by how much it's already cost. I think we need to look at the ultimate goal, speculation is not enough. We need to know exactly what we're talking about so that we can evaluate environmental impact. I want to make sure that you don't just say your one part without all of us saying, Hey, what really is going on here? At this point, I think we owe it to ourselves to look at the total picture and say no. Thank you.

COLONEL NEUPEL: Thank you. After Mr. White will be Steve Erickson.

MR. C. E. WHITE, JR.: I'm C. E. White, Jr. from Idaho Falls in Idaho. I'm here as one of the members of the delegation from the Chamber of Commerce. I might say that I spent quite a few years at the Nevada test site on the old so-called nuclear Nerva program. People are trying to relate that to what you fellas are talking about here, and it's trying to compare apples and oranges. I mean this is a different technique. It's something that's not even going to

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be tested the way we did down there with exterior testing and everything else. This has not even progressed to that stage at this point. So the environmental impact here with the way it's going to be [illegible] is not comparable to what was done at Jack Ass Flats u[illegible]s. I didn't have that written down, but I had to say that from what I keep hearing here.

The INEL has the space and the infrastructures that's required to do the development, the testing, it's completely inside, inside. As we have the containment building from the completed loss, loss of fluid test program which was at the test site. And this provides a real firm basis, we feel, for total safety possibilities in this operation up in the test area north up there. We have the people, we have the computers, the facilities, and all the extraneous things required to handle this program. INEL has the best safety record of any DOE site and has been the key site for the development of reactors for the power production and for the Naval reactor program. We feel that this puts us in a category entirely different from the Nevada test site. We have never had exterior shots. I watched twelve of the things from behind sand bunkers eight and nine miles away. We're not going to have any of that. You're not going to be able to go out there early in the morning and watch the mushrooms go up. I think the main interest maybe to Idaho residents is that they're not downwind from us. Thank you.

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COLONEL NEUPEL: Thank you. After Mr. Erickson will be Rosemary Holt.

MR. STEVE ERICKSON: Several months ago the Air Force came out and held scoping hearings on this proposal. At that time you passed out these similar cards for names,

22 1.8 addresses, and speakers, et cetera. Well, I know of many people, myself included, Downwinders as an organization included, that filled out those cards, we've never received a copy of the Draft Environmental Impact Statement. It seems to me that one of the main requirements of NEPA as a process is that the Air Force do all within its ability to get the word out to the public to disseminate information to interested parties. In fact, I think it says that up there on that slide, if I'm not mistaken.

It makes it very difficult for people to make specific comments about a project when they don't have the opportunity to effectively review it. That's a very minor criticism of what is clearly a distorted illegal process being conducted here by the Air Force and its affiliated agencies.

23 1.10 Which, again, we still have not been given any additional information despite the fact that we requested specifically in the scoping hearings answers to questions about who's the main proponent of this particular project. Is it the Air Force? Is it the Strategic Defense Initiative Office, SDIO? Is it NASA? Is it Lewis? Is it Phillips? You know, we have never

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received any coherent answer to that request which was made in those hearings last spring here in Salt Lake City. What we've got here is exactly what Ms. Lazar said, and that is a piecemeal process being conducted by the Air Force to put a pest -- patina of compliance with the National Environmental Policy Act.

I have gone through numerous similar processes with both the Air Force and other branches of the federal government and you get to twist the process the way you want to until somebody takes you into federal court and then you have to find out whether or not you need to redo it. It appears to me that the Air Force has on occasion used site specific environmental impact processes for projects like this narrowing the selection down to a very small number of specific questions and then proceed from there to a problematic environmental impact statement and then we [illegible] the big picture.

24 1.2 In this instance, we specifically requested that you go the other way around. That we get a look at the big picture so that we can analyze precisely what the particle bed reactor program is designed to do, and where it goes from here.

Now I think that the people in Idaho are correct in assuming that the Air Force can operate this particle bed reactor test program on the ground in containment safety.

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24 cont. 1.2 We've operated reactors around the country in a variety of places, as you're well aware, most of them quite safe. That's not the point here. The point here is that we need an analysis by this agency or whichever agency it is that's actually running this show, to detail what are the environmental impacts of flight testing of a nuclear propelled rocket? What are the impacts of the operation of this program once flight testing has occurred and the program goes into full operation?

To say that we're, you know, developing a transistor here or that this is similar somehow to the development of a lawn mower engine is, you may have your eyes on space, but you must think our heads are in the clouds. We know darn good and well, and so do you, that this is entirely a project designed to get us into space. Whether it's our equipment or whether it's our people, there's no doubt about that. That's why you've spent so much money out of the black budget over so many of the last few years for the development of the TimberWind project.

A gentleman earlier mentioned the Nerva program. No, this isn't the Nerva program, we're aware of that. The particle test bed reactor, that testing program that we're discussing here is not similar to letting a rocket nuclear reactor go critical on the stand and blow fresh fallout all the way to Montana, we realize that. We also realize there is

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a great deal of similarity between the Nerva technology and the technology being considered by NASA and by Lewis and by the Air Force in this particular project. Particle bed reactor ain't that far away from what we saw in the old days with Nerva. And it's where it is headed down the road. And so, you know, when are we going to get these kind of answers

25 1.2 from our government? When are we going to get an analysis of what will be the overall impact of this project, when it's come to its full fruition? And until we can have those kind of answers, then essentially what we're doing here is taking a very small look at a very small project and basically wasting a whole lot of everyone's time, energy and money and arriving at no particular intelligent conclusions. So if you want to get your eyes on space, get your heads out of the clouds, get our hearts out of the buck and let's get on with a reasonable process where we, as citizens, can understand what this project is meant to be.

COLONEL NEUPEL: Thank you. After Miss Holt our final speaker will be Cliff Brady.

MS. ROSEMARY A. HOLT: I'm Rosemary Holt, Salt Lake City, Utah, a member of Women Concerned About Nuclear War. We Utahns are here again to discuss the Space Nuclear Thermal Propulsion Program. We still prefer to call this project Downwind Two. But we remember it goes by the pleasant alias TimberWind. You tell us this EIS will only consider whether

the technology of nuclear thermal propulsion should be studied and tested, also whether or not to construct and operate a ground test facility. $400 million has been mentioned to start the project and where to locate the ground test site. Nevada appears to be the favored site. If this is the case, we realize Utah will be downwind again.

The decision whether to build the nuclear rocket is not part of this EIS, therefore we must conclude that this is just the beginning of a long, drawn out military DOE program. Because of still some classified material and the long-range safety that -- the long-range safety and environmental consequences of this project still have not been disclosed to citizens. Especially to citizens in the downwind area. Many of us would like to get an answer to your preliminary weather

G 18.4 questions. The answer is no, a resounding no to this boondoggle project. The real question is whether there is value to this program. It will create jobs in Nevada or Idaho is not a sufficient reason.

At this time our world hardly needs to pursue an SDI program. Nor do we need, and I emphasize need, to pursue interplanetary travel. The world we live in today has 40,000 children under the age of five dying each day from malnutrition and vaccine preventable diseases. Each year 250,000 young children die -- lose their sight for lack of small amounts of vitamin A in their diet. 100 million street

children live on this planet earth. These are just some of the problems that we should be tackling with valuable programs and projects. When you siphon off money and energy for this type of military project, you damage the environment, the human environment beyond comprehension. Again, we ask you, the military and DOE, to please get their priorities straight. File this project away somewhere for a future science fiction novel.

COLONEL NEUFEL: Thank you. Mr. Brady will be our final speaker.

(A brief pause.)

COLONEL NEUFEL: Go add, sir.

MR. CLIFF BRADY: My name is Cliff Brady. Is this on? My name is Cliff Brady. As a resident of Idaho Falls, a business owner, past president of the Idaho Falls Chamber of Commerce, veteran of the United States Air Force, and a citizen that takes great pride in the people who comprise the work force at INEL, because I believe these people can provide you with the best technical and operational expertise in design, construction, testing and operation of your space reactor. They will do it with the utmost concern for the safety and protection of the people and the environment of Idaho. These people, after all, are my friends and neighbors. In fact, the vast majority of the people of Idaho believe that our laboratory is the best run and the cleanest of all the

national laboratories in this nation. Our community knows that the INEL has been a concerned guardian of the environment of the beautiful area called Yellowstone country for over 40 years. Warts really said go west yo... man, go west, but first we have to have an EIS. If that were true, most of us would probably be at a hearing back east where our forbearers would not have jumped into a Conestoga wagon or pushed one of those little carts that you see up here at the capitol building. We'd still speak with an eastern accent because the hearings would go on and on and on. So without fear, and hoping that we will not give equal weight to that focal minority whose pitch is doom and gloom and whose real aim is

H 18.1 to hold back the future, I wish to express my complete support for your program of ground testing of space reactors at the INEL.

COLONEL NEUFEL: Thank you. Thank you, ladies and gentlemen, for your comments. Now, remember that you can make additional written comments as long as they're received by October 5th of this year. And if you'd send them to the address listed on the second page of tonight's agenda by that date, then they'll make it in and be given equal consideration with the comments received here tonight. Good night.

C E R T I F I C A T E

STATE OF UTAH)
) ss.
COUNTY OF SALT LAKE)

I, JODY L. EDWARDS, do hereby certify:

That I caused to the best of my ability be prepared into transcript form, the testimony and proceedings as they were heard before me. That said proceedings were held on the date of September 15, 1992. And that the foregoing pages numbered from 2 to 88, inclusive contain a full, true and correct account of said proceedings of the Space Nuclear Thermal Propulsion Public Hearing to the best of my understanding, skill and ability on said date.

Dated at Salt Lake County, Utah, this 2nd day of September, 1992.

Jody Edwards, C.S.R.
Utah License No. 0030100010

My Commission Expires:

December 28, 1993

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UNITED STATES AIR FORCE

IN THE MATTER OF:	HEARING ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT
SPACE NUCLEAR THERMAL PROPULSION PROGRAM	

Hearing on the draft Environment Impact Statement for the Space Nuclear Thermal Propulsion Program on September 17, 1992, at 7:10 P.M. at the Convention Center, Shilo Inn, Idaho Falls, Idaho.

COPY

CERTIFIED COURT REPORTERS
P. O. Box 51020 - 445 North Capital
Idaho Falls, Idaho 83405-1020
(208) 529-5491

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A P P E A R A N C E S

HEARING OFFICER:	COL. JAMES HUEPEL Chief Trial Judge United States Air Force Bolling Air Force Base Washington, D.C.
PANEL MEMBERS:	LT. COL. GARY BAUMGARTEL Chief, Environmental Planning Division Air Force Center for Environmental Excellence San Antonio, Texas
	LT. COL. GARY BLEEKER Phillips Laboratory Kirtland Air Force Base Albuquerque, New Mexico
DOE REPRESENTATIVE:	JIM WARNER

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September 17, 1992. 7:10 P.M.

P R O C E E D I N G S

THE HEARING OFFICER: Ladies and gentlemen, welcome to this public hearing on the draft environmental impact statement for the Space Nuclear Thermal Propulsion Program. Thank you for coming tonight. I solicit your comments and involvement in tonight's hearing. I'm Colonel Jim Huepel. I'll serve as the presiding officer for the public hearing. I'm the chief trial judge for the Air Force, and I'm assigned to Bolling Air Force Base in Washington, D.C..

I would like to introduce to you the members of tonight's panel. Lt. Col. Gary Baumgartel in the center is the chief of the Environmental Planning Division at the Air Force Center for Environmental Excellence in San Antonio, Texas. To his left is Lt. Col. Gary Bleeker, who is from the Phillips Laboratory at Kirtland Air Force Base, Albuquerque, New Mexico. Col. Baumgartel will describe the environmental impact analysis process and the results of the environmental analysis. Col. Bleeker will brief you on the proposed action and the alternatives for the program.

Now, also with us to Col. Baumgartel's right is Mr. Jim Warner from the Department of Energy's Field Office here in Idaho. The Department of Energy is a cooperating agency in this program and participated in the preparation of

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this draft Environmental Impact Statement. Mr. Warner will answer questions that you might have concerning the Department of Energy's involvement with this program.

Now, as the presiding officer for this hearing I'm not acting as a legal advisor for this action. I'm not here as an authority on the draft EIS, nor have I had any involvement with its development. My purpose here tonight is to ensure that we have an orderly hearing and that everyone who wishes to provide input or to make a comment has a fair opportunity to speak and to be heard.

Now, I'd like to explain to you the public hearing process and the procedures that we'll follow this evening. The Air Force has prepared a draft Environmental Impact Statement -- we call it a draft EIS -- on the Space Nuclear Thermal Propulsion Program. That was done in accordance with the National Environmental Policy Act and Air Force implementing regulations. I'm sure many of you were probably here at Idaho Falls for the scoping, the informal hearings, that were conducted last spring.

Now, the purpose of this formal hearing tonight is to summarize for you the results of the draft EIS and to receive your comments on the draft EIS. Tonight's hearing will be in two parts. During the first part Col. Baumgartel and Col. Bleeker will present information to you concerning the environmental impact analysis process performed for the

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Space Nuclear Thermal Propulsion Program.

The second part of the hearing is the public participation portion where you'll have the opportunity to comment on the draft Environmental Impact Statement or to ask clarifying questions.

Now, this hearing is intended to provide a public forum for two-way communications about the draft EIS with a view towards improving the decision making process. Your inputs ensure that the decision makers may benefit from your knowledge of the local area and any adverse environmental effects that you think may result from the proposed action or the alternatives to the action.

Let me say what this hearing is not. It is not a debate, nor is it a referendum. It is not a vote on the actions that have been analysed in the draft EIS or if the program is approved where it should be housed. The focus of the hearing is on the environmental impacts associated with the proposals being studied by the Air Force. So comments on nonenvironmental issues should not be raised at this hearing. Moreover, none of the Air Force panel members are the Air Force decision makers on this project.

Now, when you came in tonight, you were provided with an attendance card. You were asked to indicate on it at the bottom if you wish to speak tonight. After the presentations by Col. Baumgartel and Col. Bleeker we'll take

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a short break. Following that break you'll have a five minute opportunity to speak -- to speak either making a comment or asking clarifying questions or both. Major elected officials -- and I kind of have to put it in that category because we have a number of people here tonight and a number of elected officials, and I want to make sure that the public as well as elected officials have an opportunity to speak. Elected officials, major elected officials, will have the opportunity to be speaking first followed by the public at large. During the public at large portion I'll call on members using this card that you filled out, and I'll do it in a random fashion. I'll just shuffle them up here so everyone has a fair opportunity to speak, and everybody has a fair opportunity to speak first as well as perhaps last.

If you brought a prepared statement with you tonight, you may read it out loud, or you can leave it at the box by the microphone to become part of the record. Indeed I'll indicate later on we do have a court reporter here with us. I'm sure if you have a prepared statement she would love to have you turn that in for her use if you don't want it to actually be a formal part of the record. If you do not want to make an oral statement here tonight or to ask clarifying questions but you would like to provide your input, you may do that in writing. And we have written comment sheets. You can either use one of these sheets, or you can use your own

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correspondence sending your written correspondence in to the address listed at the bottom of this sheet or to the address listed on the second page of tonight's agenda.

Any comments that are made whether given orally or provided in writing tonight or submitted later in writing will be given equal consideration in the decision making process. Any comments that you turn in, whether you use one of these sheets or you use your own correspondence, it will become an actual part of the final record. So in that regard I would -- since I know that we have had a large number of people that have indicated that they would like to speak, I would like to suggest an alternative for you. If your comments basically would be I'm in favor of the program or I think it ought to be here in Idaho, you might want to consider whether it would be just as easy to fill out one of these sheets and turn that in so that people that might have more that they want to say than just that small part would have the opportunity to do that. If you wish to speak, then that's fine. But turn turning in one of these sheets will make sure that your comments are formally recorded in the record.

In summary I would just like to stress that this is your opportunity to provide the Air Force with any information you may have regarding environmental factors that are unknown to us and to have input into the decisions that

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the Air Force must make with regard to the proposed action.

Now Col. Gary Baumgartel will describe the environmental process.

COL. BAUMGARTEL: Thank you, Col. Heupel. Can everyone hear me? Good evening, I'm Lt. Col. Gary Baumgartel. I'm the chief of the Environmental Planning Division at the Air Force Center for Environmental Excellence at Brooks Air Force Base, Texas. Our organization is independently conducting the environmental impact analysis process for the Space Nuclear Thermal Propulsion Program. Tonight I will present the schedule for completing this environmental impact analysis process and show how the present public comment period fits into this schedule. I'll also discuss the scope of the study. And then Lt. Col. Gary Bleeker to my left will present a briefing on the proposed action and test location alternaties. Finally I will present the results of our analysis.

On March 1[illegible] 1992, the notice of intent to prepare an Environmental Impact Statement for the Spcace Nuclear Thermal Propulsion Program was published in the Federal Register. Four scoping meetings were held in April of 1992 to receive comments from the public concerning the scope of issues -- can everyone hear? Is this mike on?

THE HEARING OFFICER: Very low.

LT. COL. BAUMGARTEL: I asked if you could hear

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me, and you acknowledged.

UNIDENTIFIED: You're getting some kind of radio transmission over here.

UNIDENTIFIED: You're getting a radio transmission.

LT. COL. BAUMGARTEL: Is that better?

UNIDENTIFIED: No.

LT. COL. BAUMGARTEL: This one work?

UNIDENTIFIED: Yes.

LT. COL. BAUMGARTEL: We're supposed to be in a high tech business, but we can't run a mike. Okay. Is that better?

UNIDENTIFIED: Yes.

LT. COL. BAUMGARTEL: As I was saying, we published a notice of intent in the Federal Register back in March of this year. And then we held the four scoping meetings to receive comments from the public concerning the issues to be addressed in the Environmental Impact Statement or EIS.

After scoping we collected the necessary data and conducted the analysis. The draft Environmental Impact Statement we're here to discuss tonight was filed with the U.S. Environmental Protection Agency on August 14 of this year. The public comment period will extend until October 5th of this year, and the final Environmental Impact

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Statement is scheduled to be completed in December. Once complete the EIS will be used by the Air Force to help decide whether or not to proceed with the test program to validate the concept behind the nuclear propulsion program. We except to accomplish the record of decision in January, 1993.

A copy of the draft EIS was mailed to all groups and individuals who requested one. In addition these libraries in the state have a copy available for review. Also a copy may be requested tonight or by writing to this address shown on the slide.

In addition to tonight's hearing written comments on the draft Environmental Impact Statement will continue to be accepted at this address until October 5, 1992. After the comment period is over we'll evaluate all the comments both written and oral and perform additional analysis or change the Environmental Impact Statement where necessary. Again as in the scoping process equal consideration will be given to all comments whether they are received here tonight or received prior to October 5th. Comments after that date may not be considered in the final Environmental Impact Statement because of schedule constraints.

Once the review process is complete we will produce a final Environmental Impact Statement and mail it to all those on the original draft EIS distribution list as well as those who request a copy between now and the mailing date.

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The final Environmental Impact Statement will include comments received during the public review period and our responses to those comments.

Following completion of the EIS the Air Force and DOE will consider environmental impacts as well as other factors such as economic and technical considerations and program goals before deciding whether or not to proceed with the SNTP program. A decision will be documented and a formal record of decision, which will be published in the Federal Register.

Now I would like to present Lt. Col. Gary Bleeker from Phillips Laboratory who will describe the Air Force's proposed plan for the SNTP.

LT. COL. BLEEKER: Good evening, ladies and gentlemen. I'm Gary Bleeker. I'm the program manager for the Space Nuclear Thermal Propulsion Program at the Air Force's Phillips Laboratory at Kirtland Air Force Base, New Mexico. Tonight I would like to tell you about the Space Nuclear Thermal Propulsion program and our proposal to develop and validate the particle bed reactor propulsion technology.

The program's mission is to develop and to validate nuclear reactor technologies for use as advanced space propulsion systems. Several propulsion technologies have been and continue to be considered as viable reserach

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options. However, the Air Force considers the particle bed reactor propulsion technology to have sufficient developmental potential to warrant continued investigation.

Before we go any further I would like to explain how the SNTP program was formed. Approximately two years ago work was begun on an Environmental Impact Statement to support certain decisions concerning a classified program. The particle bed reactor technology was one of the state of the art technologies being developed under this program. However, because the program was classified the EIS was likewise classified and was prepared without public participation. Because of changing mission requirements, the program, code named Timber Wind, was terminated.

The Air Force, recognizing the potential of the particle bed reactor concept, took over responsibility for developing the particle bed reactor. The SNTP program office was formed in 1991 to lead and manage the developmental effort. Assuming this responsibility, the Air Force determined that rather than rely on a classified EIS about which the public knew nothing we would prepare a new EIS for the program with full public participation. In short, the Air Force wants to fully develop the technology that was started under the Timber Wind program.

The Air Force goal is to demonstrate the feasibility of a particle bed reactor propulsion system that

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could be operated outside the atmosphere in space as an advanced upper stage or an orbital transfer vehicle.

As stated in the notice of intent, the decisions to be made based in part on this EIS are, A, whether to continue the SNTP program through the developmental -- development of nuclear thermal propulsion technology; B, whether to construct and to operate the validation test facility; and, C, where to locate the validation test facility if the program is to continue.

Two sites are to be considered for locating the validation test facility, and both were studied in the Environmental Impact Statement. One is at the Nevada Test Site, and the other is at the Idaho National Engineering Laboratory. When this environmental analysis was begun, a third site called Quest, also at the Idaho National Engineering Laboratory, was also under consideration. However, as result of our investigations it was eliminated from further consideration due to the presence of significant cultural resources.

Before we get into the details of the program and specifics of our proposed action, I would like to provide a description of conventional chemical and nuclear propulsion systems and why the promise of nuclear propulsion is so profound.

First, the ultimate objective of any propulsion

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system is to produce very hot gas for propulsion. In a conventional chemical propulsion system, shown here on the left in the slide, two fluids, a fuel and an oxidizer, are mixed and are burned. When proper combustion occurs, a large volume of hot gas is generated. The hot gas is expanded through a nozzle to produce thrust. However, there are only a few acceptable fuel and oxidizer combinations. The efficiency and performance of chemical propulsion systems are limited by the temperature and the molecular weight of the gas after the combustion process.

The nuclear propulsion system, shown on the right, contains a reactor which replaces the combustion process in a conventional system. Thus the reactor essentially becomes a very powerful heater heating a single fluid, the propellant, to very high temperature. The propellant flows through the reactor, becomes very hot, is expanded through a nozzle, and produces thrust in the same manner as a conventional rocket.

Both chemical and nuclear propulsion systems operate at temperatures of about five thousand degrees Fahrenheit. But the key difference between the two is that with a nuclear propulsion system we can choose the propellant. By choosing the lightest propellant, hydrogen, a nuclear propulsion system can be made more than twice as efficient as a conventional one. The theoretical effect of doubling this efficiency is that the load carrying capacities

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could be increased by eight to ten times.

As a practical matter we can see real cost and weight reductions of a factor of two to five. This means a tremendous monetary savings if a safe, high performance nuclear propulsion system can be developed.

The particle bed reactor is viewed by the Air Force and others as having distinct performance advantages. The particle bed reactor would use spherical fuel particles. A typical fuel element would contain many millions of these fuel particles, each approximately the size of a grain of sand. A typical particle shown on the left contains a center of fully enriched Uranium-235 surrounded by a porous graphite layer, high density graphite layer, finally surrounded by a layer of zirconium carbide. These multiple coatings provide containment of fission products and prevent the heated hydrogen from damaging the material. The six-sided fuel element includes neutron moderator material on the outside, concentric frits and the fuel particles. The concentric frits are devices that support the fuel while allowing hydrogen to flow through the material and cool the fuel particles. Flow paths through an element are illustrated in this figure as arrows.

The array of hexagonal fuel elements would be surrounded by a neutron reflector such as graphite or beryllium to enhance reactor performance and also contains

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reactor control devices. The number of elements you see could be tailored to produce the desired thrust.

The general concept of a particle bed propulsion system involves the use of the particle bed reactor, low temperature liquid hydrogen to very high temperature gaseous hydrogen. The hot hydrogen is not burned but simply exhausted through a nozzle to produce thrust.

The major technical goals of the program include the achievement and control of predicted nuclear power levels, the development of materials that can withstand high operating temperatures and the hydrogen environment, and reliable control of low and high temperature hydrogen propellant.

In addition to the particle bed reactor itself the principal components of a conceptual propulsion system are the propellant management system and the pressure vessel/nozzle assembly.

The propellant management system provides controlled flow and pressure to the reactor and any other subsystems. During operation low temperature hydrogen exits the propellant tank and enters the turbopump assembly. After exiting the pump the propellant is delivered to the reactor where it is heated to the desired temperature. A small portion of the propellant is bled off to power that turbopump assembly.

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The pressure vessel/nozzle assembly would provide pressure containment and structural support. The nozzle collects hydrogen gas from each reactor fuel element and accelerates the gas through the throat section to generate thrust.

This leads to the description of the proposed validation testing of the particle bed reactor propulsion technology. The proposed testing sequence involves a series of tests over a five- to ten-year period leading to the validation of the particle bed reactor concept. As shown in the slide, the tests are sequenced to begin with fuel element testing on the left and culminate in testing of integrated systems. In a building block approach the test series includes a particle bed element test, which we call PIPET, and an engine integration test culminating with tests of ground test articles or engines. All of these tests would involve reactors fixed within a test cell within properly contained facilities.

Each test series would be carefully planned to include written procedures and formal review and approval. Each test sequence would undergo a comprehensive safety analysis before approval to proceed could be granted.

The multiple fuel element tests or what we call PIPET would be the first self-sustained power producing particle bed reactor test. These tests would involve a

reactor about the size of a fifty-five gallon drum and would be used to demonstrate the performance, operability, and reliability of fuel elements. Each of the nuclear cores involved in these tests could be subjected to five operating cycles at a maximum power level of five hundred fifty megawatts for as long as five hundred seconds or about eight minutes per cycle. This is the energy equivalent of a Boeing 747 flying for forty minutes. And up to ten of these tests may be conducted in a year.

Nonnuclear or turbopump tests or what we call engine integration tests, shown in a box on the right on the top, would be designed to demonstrate proper function of the propellant management system without an operating reactor in the loop. This series would establish confidence in the control and feed system necessary to allow proceeding to the engine system tests.

The integrated system tests would be a series of up to ten reactors which gradually approach the desired performance conditions. This design would evolve from technical information derived during earlier tests. Two versions of engine system tests would be conducted. They are referred to as mini and full scale ground system tests.

Subsequent to the satisfactory operations associated with PIPET, the mini system test would be tested in the same sub-scale test cell used for PIPET.

The full scale test series would take place in an expanded facility and would demonstrate complete operation with feed and control hardware and a full complement of instrumentation. The full scale engine test would be approximately the size of a small automobile. Multiple tests would be performed beginning at zero power to low power to operational power and temperatures. These tests would demonstrate controllability and stability at full power and rapid start-up and shutdown under computer control over a simulated full mission profile.

Each test would be on the order of a few minutes in duration. The maximum time at full reactor power for any individual core assembly would be approximately a thousand seconds or about twenty minutes. The energy produced from such a test would be equivalent to a Boeing 747 flying for approximately four and a half hours.

Because no facility exists that fully meets testing requirements, construction of a new test facility or extensive modification of an existing facility is required. As shown in the slide, the main features of a sub-scale facility would include a control complex, which includes an instrumentation and control system inside a bunker; a test cell; a confinement system; coolant supply system; an effluent treatment system.

The control complex would be a shielded,

reinforced concrete building from which access to the test facility, activities involving the test cell, and a system to provide video surveillance over the entire test facility would be controlled.

The control system would provide the required safety and control functions for all operations at the test facility. The system would provide remote control of all functions a sociated with the reactor testing.

The sub-scale facility would also include a test cell which would accommodate the major components of the reactor for initial particle bed validation tests.

The confinement system limits the release of fission products and would include a barrier enclosing the reactor and portions of the effluent treatment system.

The fluid systems for the sub- and full scale test facilities would consist of two major subsystems -- the incoming coolant supply system and the outgoing effluent treatment system.

The incoming coolant supply system would be composed of the hydrogen storage system, the helium storage system, and the pipes and valves for coolant distribution.

There are three major reasons for incorporating an effluent treatment system into the test facility. First, one of the goals of the PIPET testing is to validate design margins. Secondly, the emissions of radionuclides into the

ambient air from DOE facilities are regulated by the EPA in accordance with the national emission standards for hazardous air pollutants and shall not exceed an amount that would cause any member of the public to receive in any year -- to receive an effective dose of ten millirems.

While the national emission standards may allow a member of the public to receive a dose of ten millirems a year, the SNTP program is committed to a design goal of two millirems per year or twenty percent the allowable regulatory limit.

Because the SNTP program is a developmental program, there would be some uncertainty in the actual composition of the effluent. An effluent treatment system would ensure that the emissions from planned activities would remain within the program goals. Third, it is national policy to reduce radioactive discharges to a level that is as low as reasonably achievable. An effluent treatment system makes this possible.

The effluent treatment system would be designed to accomplish the following objectives: one, to ensure that radioactive material entering the effluent treatment system remains subcritical; it cools the test article effluent or exhaust to much lower temperatures to effectively treat the exhaust; it removes particulates, debris, traps noble gases and any vapor phase contaminants from the effluent stream.

Fourthly, it flares the resulting clean hydrogen gas to the atmosphere to prevent accumulation and potential detonation of the hydrogen in the vicinity of the test cell.

An effluent monitoring system would measure the radioactive particulate content of the discharge stream on a real time basis and display this information for the reactor operator to take action. The effluent treatment system design would include appropriate shielding to prevent worker exposure to ionizing radiation above acceptable levels.

The design and fabrication of an effective effluent treatment system while costly is well within the operating ranges of state of the art systems.

Construction and/or modification of all facilities is expected to take approximately eighteen to twenty-four months for both the sub-scale and the full scale test facilities with an average work force of about thirty-five and a peak work force of about one hundred.

The number of personnel on site during pre-operational activities at the smaller sub-scale facility would be limited to about thirty security, technical, administrative, and maintenance personnel. The pre-opeational staff of the larger full-scale facility would be approximately fifty to sixty. During actual testing operations for both facilities the number of personnel on site would be reduced to a minimum operating staff of no more

than ten individuals, all located within the control complex.

Two sites at DOE installations have been identified as suitable locations for the particle bed reactor validation test facility, the Saddle Mountain Test Station site at the Nevada Test Site and the Contained Test Facility site at Idaho National Engineering Laboratory. The principal exclusionary criteria considered in the site narrowing process were, one, similar nuclear activities conducted at the installation; two, fifteen kilometer minimum distance to the nearest urban area; and, three, federal ownership of the facility.

The Saddle Mountain Test Station is located in the center of the Nevada Test Site south of Mine Mountain Road and west of Saddle Mountain Road. The distance to the nearest boundary is fourteen miles, and access to the Nevada Test Site is controlled.

Saddle Mountain Test Site would require new construction of sub-scale and full scale test facilities. Other infrastructure required for the site includes power lines, phone lines, roads, a line to an existing deep water well and water storage tanks. Transportion improvements include new site roads and grading of the existing access roads.

The Contained Test Facility is located in the northern portion of INEL northeast of the intersection of

Lincoln Boulevard and State Highway 33. Some existing facilities to support particle bed validation testing are already located at the Contained Test Facility site.

Existing facilities at the site consist of a receiving, assembly, and hot cell facility; a containment structure; a control bunker; post-irradiation examination facilities; and administrative space. An approximately one and a half mile railroad track connects the containment structure to the receiving, assembly, and hot cell facility. A security fence with guard stations is also in place.

A number of modifications to the existing facility would be required. It is likely that the control building would have to be reconfigured to accommodate the tests, and the receiving, assembly, and hot cell facility may require modest modification to accommodate the hot test articles. Engineering studies have been initiated to determine if the Contained Test Facility or new test cells would be required for the larger full scale testing. New test cells if required would be located adjacent to the Contained Test Facility.

Use of the Contained Test Facility containment structure as the test cell would require construction of fluid storage and piping, an effluent testing system, and flare stack. Engineering studies are underway to determine renovation requirements for the containment test facility.

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As required by the National Environmental Policy Act, the no-action alternative was also evaluated. The no-action alternative would result in the Air Force not proceeding with development and validation testing program.

What I have presented here is a summary of our proposal to develop and validate the particle bed reactor propulsion technology. Many more details of the proposed action are contained in the draft Environmental Impact Statement. Lt. Col. Baumgartel will next present the environment impact analysis for this program.

LT. COL. BAUMGARTEL: Is this one working? Before I get started, I see some folks way out in the peanut gallery. There's plenty of seats up front. I'll be showing some slides that have some charts. It will be hard to see if you're three hundred yards down. Plenty of seats. Even if they have reserved on them, feel free to come up anytime that you feel like it. Some are up in the front here. I see some in between.

This draft Environmental Impact Statement was prepared to comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Efforts were made to reduce needless bulk, to write in plain language, to focus only on those issues that are clearly related to the environment and to integrate the EIS with other documents required as part of the decision making

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process.

This analysis focuses on impacts to the natural environment that may occur as a direct result of the particle bed reactor program and validation testing or indirectly through changes in the community. Resources evaluated are air quality, biological resources, cultural res urces, soils and geology, noise, and water -- both surface and ground water -- and indirect changes to the community that provide measures against which environmental impacts could be analyzed. Included are changes to the local employment and population, land use and aesthetics, transportation, and utility services. In addition, issues related to the current and future management of hazardous materials and waste are discussed in the document.

Because the proposed action involves transportation and testing of nuclear materials, a considerable amount of health and safety analysis was done to address radiological as well as nonradiological impacts.

If as a result of our analysis it was determined that adverse environmental impacts may occur through implementation of the proposed action and testing alternatives, potential mitigation measures were identified and analyzed in the document.

I now present the results of our analysis that are stated in the draft EIS. Both validation test site locations

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were analyzed to the same level of detail. The baseline conditions assumed for the purpose of analysis are the existing conditions at each location. In the following slides we show the comparative impacts between the test site alternatives, excluding the no-action alternative.

This slide shows the maximum projected population and employment effects from the implementation of the SNTP progarm The peak year increase of one hundred employees results in a .04 percent population increase in the region of influence for the SNTS or a two-tenths of a percent increase in the region of influence for the CTF. A maximum of two percent increase in total peak year employment would occur at NTS and a one percent increase at the INEL.

This slide shows the utility requirements for the SNTP progarm at the two alternative test sites. Under energy there is sufficient power at both SNTS and CTF for sub-scale testing. Supplemental power would be provided by mobile generators at SNTS during ground test article operational testing. Mobile generators may also be required to provide supplemental power during peak demands of ground test article operational testing at CTF.

Under solid waste an average of a hundred seventy-five tons per year of nonhazardous waste is expected from the SNTP program. At the NTS this is less than two percent of the total. The amount of solid waste generated

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will result in a negligible decrease in anticipated life of disposal capacity. At the INEL a new landfill will be operational by 1995; therefore, a negligible impact on landfill capacity is expected.

Under wastewater, at SNTS the total estimate of twenty-four hundred gallons per day of wastewater would be handled by a new septic system planned with the SNTP facility design. The same volume of wastewater at CTF wouild be well within the capacity of the existing evaporation pond system.

Under water supply, the ten thousand gallons per day of water demand for SNTP represents a small increase in demand on the water supply at either NTS or INEL.

The construction of facilities on a hundred acres at SNTS is consistent with current missions and activities at NTS, and no land use impacts would occur. The modification of existing facilities and construction of additional facilities at CTF is consistent with their current missions and activities at the INEL, and no land use impacts would occur at this site either.

This slide shows the traffic impacts of increased employees traveling to either NTS or INEL. A maximum of 5.9 percent increase in traffic is expected along U.S. 95 to NTS for construction and a maximum of only 3.5 percent increase during operations. Assuming that most employees at INEL would use commuter buses to get to the work, the SNTP program

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would cause a four percent increase in traffic during construction and a three percent increase during the program operation along State Route 33. None of these traffic increases is expected to cause adverse impacts to the levels of service provided by these roads.

The next two slides discuss the transportation and use of radioactive and nonradioactive hazardous materials and the storage and disposal of hazardous wastes. The health and safety aspects of hazardous wastes will be discussed shortly.

Under hazardous materials, the largest quantity of fuel material to be transported in a single shipment would be the reactor cores. Department of Transportation, Department of Energy, and Nuclear Regulatory Commission regulations and requirements would be followed to ensure no adverse impacts from these or other transportation activities. These precautions would be required for either the SNTS or CTF sites.

Under nonradioactive hazardous waste, there are approximately five hundred cubic feet or seven fifty-five gallon drums of nonradioactive hazardous waste consisting principally of solvents would be generated from either site over the life of the program. All waste would be labeled and shipped to an EPA permitted treatment, storage, and disposal facility.

Under low level waste, low level radioactive waste

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requiring disposal would consist of solid wastes from the handling, cleaning, and disassembling of the canister assemblies and contaminants removed from the effluent stream. Over the life of the project it is anticipated that 1.6 million cubic feet of low level waste would be generated. This low level waste would consume eighteen percent of available disposal capacity at NTS or forty-six percent of available disposal capacity at INEL.

Under mixed waste, mixed waste such as low level radioactive materials contaminated by solvents or solvent residues may be generated -- may be generated with this project. It is anticipated no more than seventy cubic feet of mixed waste materials would be generated annually. NTS has sufficient capacity for storage and disposal. INEL has sufficient capacity for storage and is awaiting permitting of a disposal facility.

Disturbance of ground and construction of facilities at SNTS or at the CTF would generate some fugitive dust, which is regulated by the National Ambient Air Quality Standards as particulate matter. There would be emissions from construction vehicles. Emissions from the operational phase would include those from additional traffic and from site activities such as the use of diesel generators and flaring hydrogen during particle bed reactor tests. The impact on regional and local air quality from either the SNTS

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or the CTF alternative would be negligible and is not expected to affect the attainment status of the region.

This slide summarizes the impacts to biological resources from the project at the two alternative sites.

At SNTS there would be a loss of a hundred acres of transitional desert association habitat, which is a common community. Construction of the facilities and improvements to the access road may impact up to one thousand Joshua trees also. From project operations noise may affect wildlife, and the flare stack would kill any birds flying into the flame. However, noise from the flaring would very likely scare birds away that might fly over the flare stack during operations. Also at the site there's no impact to threatened or endangered species.

At CTF there would be a loss of less than fifty acres of previously disturbed land that is very low quality habitat. Project operations -- again noise and flare stack -- would have similar impacts as at SNTS. The only threatened endangered species, the bald eagle, has been observed approximately twelve miles from the CTF and foraging near the mountains north and west of the INEL. The only possible impact would be from the flare stack, and this is considered unlikely because of the distance, the noise from the flaring operating, and its intermittent nature.

This slide summarizes the results of cultural

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resource analysis for the two alternative sites. At SNTS seven prehistoric sites were found within the region of influence. None of these sites is considered significant under the National Register criteria. Therefore, no adverse impacts are expected to occur to archeological resources. No historic, Native American, or paleontological resources have been identified at the SNTS.

At CTF the only known cultural resource that may be affected is the existing facility at the CTF, which retains qualities that would make it potentially eligible for the National Register of Historic Places. This is beause the CTF is the only nuclear reactor test facility of its size in the world designed to simulate all of the important events that could occur in a commercial pressured water reactor power plant. Consultation between the Idaho State Historic Preservation Office and the Advisory Council on Historic Preservation and INEL is addressing the issue of national register eligibility for several INEL properties. A memorandum of agreement to outline various mitigative requirements is currently being prepared. Until the consultation process determines the eligibility of the CTF for the National Register it will be considered a potentially significant historic resource. As such modifications proposed by the SNTP could have an adverse effect. Mitigation measures may be required if this site alternative

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is chosen. If it is determined that the CTF is not eligible for the National Register, then no cultural impacts are expected at this site.

Under geology and soils, as mentioned previously, the construction of new facilities would require disturbance of a hundred acres of land for the SNTS and less than fifty acres of land for the CTF. The SNTS would require excavation of twenty-six thousand cubic yards of material and the placing of thirty-seven thousand cubic yards of fill, while the CTF would only require excavation of three thousand yards and placing of four thousand yards for fill. Measures would be taken at either site to suppress dust and soil erosion. No impacts -- also no impacts from seismic or volcanic activity is expected.

High noise levels at SNTS are not expected to cause impacts to nonproject personnel. The projected hundred twenty-five decibel noise level from operations would be attenuated before reaching nonproject personnel and other sensitive community receptors. The nearest nonproject personnel would be approximately six miles away, and the nearest community is approximately twenty-three miles away.

Noise levels at the CTF are also not expected to impact similar receptors. The nearest nonproject personnel are approximately one point three miles from the CTF, and the nearest community is approximately eleven miles away.

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There would be a short term noise effect on wildlife in the immediate vicinity of the test facility during test operations. Again this may have a beneficial side effect of scaring birds away from the flare stack during operation.

The 3.7 million gallons per year of water required for the project are not expected to cause drawdown in the aquifers at either the SNTS or the CTF. No water quality impacts are expected from normal operations at either site.

Turning to health and safety, this slide is a chart showing results from maximum case radiological modeling of normal testing operations as compared to the national emission standards. The program goal is the radiation dose that would be received naturally. In summary, the SNTP program exposures to the maximally exposed public are much smaller than the annual regulatory limit for routine exposures. These calculated exposures are also considerably smaller than the annual exposure rates due to naturally occurring radiation. For the NTS area the maximum single year exposure would be only .6 millirems, which is .14 percent of naturally occurring exposure. For the INEL area the maximum single year exposure would be 1.35 millirem, which again is only .31 percent of the naturally occurring exposure.

These doses represent upper bounds of the

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potential exposures and have been calculated using extremely conservative methodology. In summary, no adverse radiological impacts are expected as a result of the propoosed action at either site.

This slide shows the results from radiological modeling for maximum case credible accident scenarios. Maximum case credible accident assumptions consist of simultaneous failure of two critical ETS components resulting in a release to the environment. In developing the maximum case effects shown here all weather conditions were looked at, and consideration was given to multiple concurrent internal and external exposure to hydrogen.

The maximum credible accident exposure at NTS would be only 23.5 millirems or 5.6 percent of the natural dose. The maximum credible accident exposure at INEL would again only be thirty millirems or 6.8 percent of natural dose. In comparison the recommended maximum twenty-four hour accident exposure level is five hundred millirems or more than fifteen times the maximum accident exposure at either site.

As with normal operations exposures -- as with normal operations exposures the maximum accident exposures represent the upper bounds using extremely conservative methodology. Also the analyses do not include mitigation measures such as evacuations and remediation which would be

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undertaken in the event of an actual accident.

Looking at worker exposure, the Department of Energy suggests a design goal of a maximum of five hundred millirems annual dose for radiation workers. A hundred fifty workers at the SNTP facility could therefore be exposed to as much as seventy-five thousand person-millirems over the ten years of the SNTP program and meet this goal.

Also a goal of the SNTP program is to maintain exposures of on-site nonprogram related personnel to a much lower level of only twenty millirem per year.

Based on this goal, the forty-five hundred workers at NTS could receive up to nine hundred thousand person-millirems or only a 4.7 percent increase over natural exposure levels of nineteen million person-millirems which would be received during the ten year period of the SNTP program.

The eighty-five hundred workers at INEL would receive not more than 1.7 million person-millirems or only -- only 4.5 percent increase over the natural exposure levels of 37.5 million person-millirems received in the ten years of the SNTP program.

In the area of chemical safety, the SNTP program would use several liquid and gaseous chemicals in support of the program. Hydrogen is classified as a simple asphyxiant. Its greatest hazard is from its extreme flammability range,

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which can lead to fires or explosions. Oxygen, although not flammable itself, supports and accelerates combustion. Nitrogen and helium again are simple asphyxiants and nonreactive.

Numerous facility designs and handling procedures would be established to ensure that these hazards are minimized when using these chemicals. These designs and procedures will be implemented to ensure hazards are minimized.

There are no site-specific issues with the SNTS site in terms of chemical safety.

Use of the CTF for testing purposes may allow the buildup of hydrogen inside the facility during test operations. Following test completions, venting of the structure would be required before personnel could enter to reduce the potential of explosion or asphyxiation.

Several analyses were performed that considered potential impacts from the transportation of radioactive materials. For the nonaccident case of transportation of radioactive materials to NTS the calculated total population dose received for the program duration would be a hundred thirteen thousand person-millirem. In addition, less than one person-millirem is projected as a result of anticipated transportation accidents. For nonaccident transportation of radioactive materials to INEL the calculated total population

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dose for the program duration would be a hundred thirty-two thousand person-millirems with the addition of one person-millirem projected as a result of anticipated transportaion accidents.

In all cases the population dose would be distributed among a large total population with no member of the public receiving a dose in excess of one millirem, and the majority of exposed individuals receiving a total dose which is immeasurably low.

Beryllium is under consideration for use in the particle bed reactor. Inhalation of beryllium particles may lead to bronchitis and pneumonia, and it is a suspected carcinogen. The only likely release of beryllium would be from a catastrophic failure. However, no credible accident scenario is conceivable that could produce considerable amounts of beryllium.

Based on a maximum case release, the total exposure to any individual would be no greater than three ten-thousandths of a milligram. This exposure would be more than fifty times less than the Occupational Safety and Health Administration permissible exposure level of one point -- of a hundred seventy-three ten-thousandths of a milligram in a twenty-four hour period. Therefore, beryllium release is not expected to be a significant impact under any circumstances.

This completes my review of the Draft EIS. Our

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goal is to provide Air Force decision makers with accurate information on the environmental consequences of this proposal. To do this we are soliciting your comments on the draft document this evening and prior to the 5th of October. I'll now turn the meeting back over to Col. Heupel.

THE HEARING OFFICER: For those of you who came in late, if you wish to speak, ask you to fill out a card and check at the block that you want to speak. If your comments are only to be on the record indicating your support or your opposition to the program or specific location such as Idaho, since we're in Idaho, that you would like to see the program at, we urge you to put that on one of the written comment sheets and just turn that in tonight or mail it in to the address listed at the bottom so that people that do have other things to say will have a greater opportunity to speak tonight.

Those of you that were in the back of the room and were shy about moving up when Col. Baumgartel mentioned that earlier, I urge you to go ahead and move on up to the middle or the front of the room after the break. We promise unless you've turned in a card we won't call on you, or there won't be any questions on this afterwards, at least any test questions.

The other thing I need to say something about because it's -- as part of a formal hearing it is important

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with regard to signs -- signs are fine in the back of the room. In the front of the room they're not. These are rules that have applied throughout -- Las Vegas, St. George, Salt Lake City, and people of all persuasions and viewpoints as far as whether the program should be funded -- should exist or not or whether it should be funded have all courteously complied. So I ask your cooperation. And whoever put the sign down in front I'd ask you to move it towards the back. We'll take a ten minute break.

(Brief recess)

THE HEARING OFFICER: We are now going to start the public comment portion of this hearing. I want to ensure that everyone who desires to speak tonight will have a fair chance to be heard. As I indicated earlier, we do have a court reporter who is taking down word for word everything that's said tonight, and the entire record will then become a part of the final Environmental Impact Statement and the decision package. Just as well as that record any comments that you submit in writing -- whether you submit them tonight or if you mail them in by October 5th, those will also become a part of the final Environmental Impact Statement and the decision package. I ask you to help me follow these ground rules.

Now, I'll announce the name of the first speaker and the name of the second speaker. We have two microphones

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up here. I ask you to get to either the closest one or the one that's not occupied and for the next speaker to be ready to start in just about as soon as the first speaker has finished. And I ask you to do that so that we can get as many of the speakers that have indicated that they want to speak -- we can get as many of them in as possible tonight. We've got forty-five plus cards up here, depends upon how long people take as to -- as to how long -- whether we can cover everyone or not. That's also part of the reason I made my comments earlier. I renew them. If you just want to indicate you're in support or in opposition or you're for one location or against another location, you want to be on record, we urge to fill out a comment sheet, just to do that, because our particular interests are with regard to the environmental effects. Your comments put on this will be given equal consideration, but that lets us get to people that have additional things that they want to say.

If you've already submitted a card and we don't call on you and you've decided that you want to fill out a comment sheet, just holler out I'm going to do a comment sheet, and we'll move on. And I suppose the other is if you basically agree with what somebody previously said, if you just want to come up and indicate that, and then let the next speaker come up, that's super too.

Please speak only after I recognize you and

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address your remarks to me. And if you do have written statements or documents you wish to submit tonight, we do have baskets on the tables by the microphones for those to be placed in. When you start in, I ask you to speak slowly. Indicate your name, what city you're from, and what capacity you're speaking, whether you're speaking as an elected public official, whether you're speaking as a representative of an elected public official, whether you're part of -- a speaker for a designated group or if you're speaking as a concerned citizen.

Now, I'll represent to you -- excuse me. I will recognize each speaker for a maximum of five minutes. That time limit is particularly important with the number of speakers that we have here. I try to give everyone an equal opportunity to be heard. When the five minutes are up, I'm going to raise my hand and ask you to -- as soon as you see my hand, go ahead and conclude your comments. Finish what it is you're saying, but don't move on to another thought. If you've got more things to say than five minutes will allow, I ask you to just prioritize and cover the most important points first.

If I call the name of someone who is not in the room, I'll hold that card until just before the next break when I'll call the name again. If the speaker is still not present, I will not call their name to speak again.

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And lastly I'd just ask the entire audience to be courteous and not to talk while the recognized speaker is speaking. Again to conserve time I ask you not to applaud. That just makes it longer for somebody to be able to get their comments in, makes it a little bit more difficult.

With that we'll go into the first portion of the public comment period, elected -- major public officials being called. The first speaker will be Mel Richardson, who is representing Senator Stephen Symms. And then will be Jeff Shrade representing Senator Larry Craig. Mr. Richardson.

MR. RICHARDSON: Col. Heupel, thank you very much And Senator Symms sends his regrets that he could not be here tonight because of the pressing duties in Congress, but he did send a four-page statement, which I'm sure with the number of people speaking tonight he would not want me to read. So I'm going to just take and highlight statements, but, sir, I do have a complete text which I would put into the record and would appreciate, of course, if they could be carefully observed by the Air Force.

THE HEARING OFFICER: Thank you.

MR. RICHARDSON: The SNTP will provide the Air Force with the capability to move large satellites into higher orbits and may provide capability to move satellites to areas of conflict more quickly. This will be very beneficial capability. As our nation reduces conventional

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military assets, we will increasingly need prompt, high quality, high quantity means of gathering intelligence information. SNTP could help achieve those goals. The next natural step for this program is deployment of the ground test facility.

There are many environmental impacts related to this action. Impacts include noise, the disruption of transportation, grazing activities, risks posed by the handling of radioactive and hazardous materials and treating the effluents and handling waste that will be generated by the project. Let me assure the Air Force that Idaho is ready and able to meet all of the challenges imposed by these impacts. In fact, I believe also Idaho National Engineering Laboratory is the ideal location for siting the SNTP program. Your final Environmental Impact Statement should reflect this fact.

It goes on, addresses the environmental risks, but one comment I would like to read from: I can tell you that INEL management has done an outstanding job of communicating and working with the agencies and private entities concerned about transportation and grazing issues in the past. It goes on and gives several reasons.

As you can see, INEL has a very good record of working with Idahoans concerned about transportation, grazing issues relating to the Site. On the ground and in the air

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INEL is a good neighbor. INEL also has an extraordinary track record of handling radioactive and hazardous material. He talks further about that. He says: in recent years INEL has taken a national leadership role in waste management and environmental restoration technology and development.

I would just go to the conclusion at this point, but I do point out the fact that he has given several very good reasons and analyzing why this -- and the environmental concerns, but he says: the conclusions are obvious. The SNTP program and the ground testing facility for the PBP reactor should be sited at the INEL to minimize the most significant environmental risk.

By incorporating the comments I made tonight regarding the Environmental Impact Statement for SNTP I am confident that Idaho will be the preferred choice in the final record of decision. Thank you for your consideration of my comments. I hope our visitors from United States Air Force will enjoy their visit here in beautiful eastern Idaho.

Sir, you've granted me for just one moment for personal testimony, and I will say that I am State Representative Melvin M. Richardson representing District 30. Also I will be representing the state at the State Senate, not having an oponent in November. But I would like to just take a brief moment. Many people are supporting this program at the INEL because of the local economic reasons. I

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certainly concur with these. It is important, but I have another reason.

Each day our country moves toward a world marketplace and increased world competition. To maintain our preeminence I feel we must lead in space exploration and the development of technology and the tools necessary meeting the frontiers of the future including the environment. America cannot afford to be in second place. That's why we need a first place facility. That's why the Air Force needs the INEL. It is the logical place. All phases of the program can be done at the INEL and done safely, which, of course, has great environmental impact.

The INEL has a successful history of nuclear development and testing and while maintaining the safety of the workers, the populace, the aquifer, and the land. We have faith in their dependability. Work on a space reactor has been going on at the INEL. So has work in robotics in space. INEL offers experience, expertise, necessary facilities for every phase of the project, land and room for expansion if necessary, and above all the nation's finest staff for this type of project. This project is perfect for INEL. The INEL is perfect for the SNTP program.

I know I speak for many of the state legislators -- I talked to them before this meeting -- who could not be here tonight. I speak for them when I say Idaho and America

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needs SNTP and we want SNTP. You you very much.

THE HEARING OFFICER: Thank you. After Mr. Shrade will be Linda Milam representing Congressman Stallings and -- my apologies, Mr. Shrade. Rather than having you stand if you just come up, have a seat near one of the microphones. It will probably make it a little bit easier.

MR. SHRADE: It will make it easier. My hands are all sweaty right now.

THE HEARING OFFICER: Mr. Shrade.

MR. SHRADE: My name is Jeff Shrade. I'm a regional assistant to United States Senator Larry Craig. I have letters of support here from Senator Craig, U.S. Senate candidate Dirk Kempthorne. We have a copy of Senator Symms's statement which has just been shared with you, have a copy of -- copy of a letter of support from United States Senator Jim McClure, who is now retired. We also have here a statement of support from the Bonneville County Republican Central Committee, which I happen to be the chairman of.

Let me just say briefly I will submit these -- submit this testimony for the record rather than reading it here and making these people suffer. But let me just say that political will is here. We want you to come to Idaho Falls. We want you to come to Idaho. We support the Air Force. We believe you can do it in a safe manner. If you're going to spend the taxpayers' dollar, we want you to spend it

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in Idaho. Thank you very much for coming.

THE HEARING OFFICER: Thank you. After Ms. Milam will be David Humphrey representing Governor Andrus. Ms. Milam.

MS. MILAM: Thank you. I will read a fairly brief letter from Congressman Stallings. Dear Colonel: I appreciate the opportunity to express my strong support for the space nuclear thermal propulsion program and to endorse the siting of the Air Force ground test facility at the Idaho National Engineering Laboratory. I wish I could join you and the many INEL supporters tonight for this important public hearing on the draft Environmental Impact Statement. I regret that legislative business in Washington prevents me from attending. However, I wish to make it clear that I believe the Idaho laboratory is the ideal location for this important test facility.

The INEL is a worldclass facility, and the people of our state are proud of it and of the jobs it brings to Idaho. It has a long and distinguished history, and its forty year record of achievement and responsible management is recognized throughout the U.S. and the world. As a leading international center for nuclear research and development, its talented work force, excellent facilities, unique capabilities, and fine safety record offer the right environment to conduct this critical program.

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I believe the INEL can play a national leadership role as a major space exploration and research and development center for nuclear propulsion and electric power. In fact, the IN'L has been assigned the lead laboratory role by the Department of Energy in planning the nuclear propulsion program for the national space exploration initiative. Organizations supporting this research could quickly assume the technical roles associated with the space nucle. . thermal propulsion program.

Let me highlight several major reasons why I believe the Idaho laboratory is the best choice for the ground test facility. First, as I mentioned earlier, the INEL has more than forty years experience in nuclear reactor design, testing, and safety. It also maintains a quality staff with worldwide recognized expertise. These technical skills are necessary for our country to have a successful nuclear thermal program.

Second, the INEL already has many of the facilities in place that would support testing and including the assembly building, hot cells for examining materials and handling large equipment and the transportation system.

Third, this difficult period -- during this difficult period of national budget constraints the INEL offers an existing infrastructure -- equipment, building, roads, and people -- to support the full range of activities

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in the most cost effective manner. Since the Idaho laboratory already has the technical team and facilities needed to make the program successful, testing could be started sooner and cost less than at any other proposed location.

In closing I support the continued development of the space nuclear thermal propulsion program and the construction of a ground test facility at the INEL. I have confidence that the Air Force will be able to construct and operate this facility in a safe and environmentally acceptable manner.

Once again I appreciate the opportunity to share my comments. Sincerely, Richard H. Stallings, Member of Congress.

THE HEARING OFFICER: Thank you.

MS. MILAN: I am not going to go through my statement. It's fairly short. I'm also here this evening as a member of the Idaho Falls City Council. I will put this in the basket. Also you have written comments that have been submitted by the mayor and the president of the Council. We're all in support of the program. Thank you.

THE HEARING OFFICER: Thank you, ma'am. After Mr. Humphrey will be state auditor J. D. Williams. Mr. Humphrey.

MR. HUMPHREY: Thank you very much. I'm David Humphrey, deputy director of the Idaho Department of Health

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and Welfare. I'm also serving as the governor's coordinator for the state of Idaho INEL Oversight Program.

I'm pleased to be here to testify on behalf of Governor Andrus this evening concerning the draft Environmental Impact Statement regarding the location of the SNTP project at the INEL. The state of Idaho supports this project provided there are adequate investigations of any adverse environmental or health impacts that might result from this operation.

For more than forty years the INEL has been the nation's premier nuclear reactor research and development testing facility. Its history of successful demonstrations on a variety of civilian and defense nuclear reactors validates selection of INEL for this particular project.

In February of 1982 Governor Andrus had a briefing on this project on the goals and objectives of it. We have reviewed the draft Environmental Impact Statement, and we have identified some areas that I would like to cover briefly this evening where more information or clarification is desired by the state of Idaho.

We're looking at four major categories: first, jobs and economic impacts; secondly, the volume of waste that we can expect to be generated from this project; thirdly, the types of waste that will be generated; and, last, the disposal options for that waste.

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1 First, the Air Force and DOE-Idaho have presented this project as one that will create new jobs in Idaho, of course. On closer examination we find that in the Environmental Impact Statement the actual involvement of INEL personal or additional jobs is somewhat limited. However, it
1.3 is suggested by the governor that two major phases of the project, component fabrication phase and the post-operational research phase, be planned or we encourage their operation at the INEL. This would give our -- of course, our state and our facility here in Idaho a greater overall role in this project and one that we certainly think we're capable of handling.

1A Secondly, the final Environmental Impact Statement must provide more detail on the amounts and impacts of waste
6.2 generated and attributed to the three main phases of operation, effluent cleanup, and facility decommissioning and decontamination.

The volumes of some wastes are not described in sufficient detail according to reviews by my staff to allow predictions on how much the project will affect waste
2 handling capabilities at the Site. As an example, estimates indicate this project will generate one point six million
6.3 cubic feet of low level waste over its ten year life span. Annually the DOE-Idaho produces a hundred and two thousand cubic feet of low level waste. So taken at face value this

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2 cont'd represented approximately a hundred and fifty-seven percent increase in the generation of low level waste.

However, upon examination ninety percent of that volume is coming from the demantling decommissioning of
6.3 bearing of the actual facility parts and the effluent treatment systems as well. So I would encourage you to look at waste management techniques such as segregation, alternative uses of facilities rather than dismantlement, which might provide less production of low level waste than is anticipated in the Environmental Impact Statement.

3 A third topic involves how low level waste is characterized. This is the issue of the ten to one hundred nanocuries per gram matter. The RWMC is selected as a
6.4 disposal site for low level waste. And in the report it indicates that that would be up to one hundred nanocuries per gram level. The RWMC is not authorized to accept over ten nanocuries per gram. So we have a level of definition that needs to be sorted out on the disposal of low level waste.

4 Also the handling of mixed waste -- although I understand from your presentation this evening those volumes would be fairly low -- is a significant issue, because mixed
6.6 waste produced by this program must be disposed of. I'm not sure that you can count on WPP or any other ideas for repositories down the road to handle that waste. So certainly I think there needs to be some dialogue between the

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4 cont'd state, EPA, the Air Force, and DOE regarding how the mixed waste will be handled, because I think that's a very sensitive issue, not just for the INEL, but it's a national
6.6 issue that must be addressed. And we are working with EPA and DOE on that now. We would like to involve you in those kinds of discussions.

In conclusion I would like to say that we reiterate our state support for this project given clarification of our questions, and I have a complete statement I submitted here. And we would encourage, of course, the full scope of the activities proposed in this project be conducted here in Idaho. We think we have the resources to do it, and we certainly would welcome that opportunity. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Williams will be Susan Crapo representing -- am I pronouncing it right?

UNIDENTIFIED: Crapo.

THE HEARING OFFICER: Crapo. I'm sorry. With a name like Huepel I do it to others at times. She's representing Mike Crapo, who is the president pro tem of the Idaho State Senate. Mr. Williams.

MR. WILLIAMS: Thank you, Colonel. My name is J. D. Williams. I'm the state auditor of Idaho and a member of the State Land Board. I'm from Malad here in eastern Idaho

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currently residing in Boise. I'm here tonight to speak in support of siting of the space nuclear thermal propulsion project at the Idaho National Engineering Laboratory. I feel such a project would represent what I perceive to be a necessary evolution in the mission of the INEL in light of new priorities dictated by a changing geopolitical landscape.

It's already been documented the achievements in nuclear reactor research and development over forty years at this installation. Its contribution to our nation's defense goals in a time of great uncertainty and fear has earned it the gratitude of all Americans. But now thankfully the temper of the times has changed. The mission of the INEL is free to change also. And this project is one example of the new direction that INEL should take to harness the creative energies of the men and women of the Site who have served our nation so well and still have so much to give.

This project we discuss tonight represents one
A potential step in that evolution. As the testimony given tonight has indicated, the state of Idaho would welcome a decision by the federal government to locate this project at
13.1 the INEL. I concur in this endorsement, and I would work together with other state officials and our congressional delegation to convince all agencies of the government that this is the right place for this research with the right people at the right time and at the lowest cost.

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This having been said, it is important to communicate within this forum that the environmental integrity of Idaho must be maintained for all of our citizens. As Idahoans we are fortunate to live in one of the great last best regions of America in terms of a preservation of a very superior quality of life. No new enterprise no matter how important to our economy or any mission can be issued a blank check that would draw against the health and safety of our citizens.

However, I believe this project as envisioned in the draft Environmental Impact Statement will not detract from those qualities of life and in fact will have considerable political support for both phases of this project. I don't see instances where roadblocks will be placed in its way because it will be a very important part of the future mission of the INEL. Thank you.

THE HEARING OFFICER: Thank you. After Ms. Crapo will be State Senator Lee Staker.

MS. CRAPO: My name is Susan Crapo. And that's not the first time it's pronounced wrong, and I'm sure it won't be the last. I'm representing my husband, Mike Crapo.

Col. Heupel, members of the Air Force, fellow eastern Idaho residents, friends and neighbors: because I cannot get here in time tonight to present this testimony personally, thank you for giving my wife Susan the

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opportunity to share my thoughts with you regarding the space nuclear thermal propulsion program. We all recognize the central role that INEL can play in America's future. Idaho has the potential through INEL to become a central factor in the development of national energy policy and practices. My personal vision of the INEL's mission is that INEL should play a meaningful and expanded role in the development of solutions to the nuclear industry's waste and reprocessing problems, medical research and applications, development of commercial electrical power, America's aerospace program, and emerging nuclear technologies.

B 13.1 Consistent with this mission I support the location of the space nuclear thermal propulsion program at the Idaho National Engineering Laboratory. This program offers great promise in advancing our capacity to explore space. Furthermore, benefits will inevitably accrue to our national security, to our technology base, to our economy and job growth and to maintain our edge in international competition.

This program would fit the expertise, the physical facilities, and the record of safety at INEL. In fact we can handle this project here. We want the chance. Part of our quality of life around here is due to our ability to provide jobs for people and families. This project would certainly help in this regard.

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I was born and raised in Idaho Falls. I was educated in Idaho Falls schools. I now work and am raising my family in Idaho Falls. I grew up playing in this desert and in the rivers fishing, swimming, and rafting. And I want this same quality of life available to my children. Not one of us in this room wants nor can possibly benefit from any environmentally irresponsible behavior at INEL. Any project at INEL must comply with environmental protection laws and must be sufficiently funded to assure that they will be operating cleanly and safely. I expect that this space nuclear thermal propulsion program meets this criteria, and again I urge its location at INEL. Thank you.

THE HEARING OFFICER: Thank you. After State Senator Staker will be State Representative John Alexander.

MR. STAKER: My name is Lee Staker. I'm state senator for Bonneville and Teton Counties. I'm not seeking reelection, but I am going to be a county commissioner here in Bonneville County. As a state senator I've been very actively -- and have supported the INEL. I pledge my support as a Bonneville County commissioner to this program and to INEL's future. If the Air Force deems it possible to come here, I will be your ally. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Alexander will be Dick Kenny representing State Senator Hansen. Mr. Alexander.

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MR. ALEXANDER: Thank you. My name is John Alexander. I'm a state legislator representing Bannock and Power Counties. I also reside in the city of Pocatello. I would encourage you to evaluate all the sites on their true C 13.1 merits. You've demonstrated many things tonight which to a lay person such as myself would indicate that the INEL would be a superb site for location of this fine project.

Idaho has and does support nuclear research and work at the INEL. During a time in which our country needs to move ahead in nuclear rather than chemical propulsion we need to look at cost effectiveness of the potential sites, the productivity of Idaho workers, and the reasonable cost of land, utilities, and labor which make Idaho an excellent choice for this project.

I would also indicate that Idaho has a long support for nuclear research and development. We hope that you will bring this Air Force project to the INEL. We, the people of Idaho, stand in support of nuclear research and the work taking place at INEL and will continue to do so. And we would like to have the opportunity to welcome the Air Force to the INEL so that we might be able to expand projects in the future. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Hansen will be Mr. Con Mahoney representing speaker Tom Boyd and then himself. Mr. Hansen.

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MR. KENNY: Senator Hansen regrets that he was not able to be here but asked that I read this. It says: I appreciate the opportunity to appear and present brief testimony at this hearing. I reside in and am a native of D 13.1 Idaho Falls. I appear here as state senator, attorney, parent, and grandparent. I strongly urge the space nuclear propulsion proposal of the United States Air Force to be authorized and sited at INEL, this nation's premier nuclear research facility.

Location of the space nuclear program at the INEL makes sense physically and environmentally and fiscally. The INEL is isolated and has a low population density. Construction and operational activities will not impact other operations or activities. It simply makes sense to locate the proposed facility in the remoteness of the sagebrush at INEL.

INEL has a pool of highly skilled and trained personnel and the experience and infastructure to provide an operational test bed that will ensure the safety of the facility at all stages of construction and operation and ensure protection of our environment and the health and safety of our citizens. These technical skills are essential to the successful space nuclear program. The quality of life in eastern Idaho, progressive communities, quality schools, first class transportation facilities, and ready access to

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several of the most beautiful outdoor recreation areas in the nation will serve as an attraction to any additional personnel required for the program.

The INEL has the existing facilities to support the program, including assembly buildings, hot cells for examining materials, and handling large equipment and a transportation system. The reactor testing for the program will take place at the Contained Test Facility at Test Area North. This facility will protect workers, the public, and the environment from any potential release of radioactive material in case of an accident.

The CTF will be equipped with scrubbers to remove radioactive contaminants from exhaust releases to the atmosphere during tests. The safety record of INEL is exemplary. Since 1951 fifty-two reactors have been designed, constructed, operated, and tested at the INEL, more than any other facility in the world. INEL has built prototypes for reactors located throughout the world. INEL has pioneered and achieve an international reputation for capability and excellence in nuclear reactor safety and design and the handling of nuclear materials.

Much can be said about the outstanding contributions or quality colleges and universities have made in serving the needs of INEL and the significant benefits which have in turn accrued to our educational institutions

from the diversified development of INEL. Idaho has become the national center for excellence in nuclear technology. Its new Ph.D. nuclear engineering program is the first started in the nation since 1965. We have developed and are operating a graduate program in hazardous waste management and site restoration that is unique in the nation.

We take great pride in the development of INEL and its many accomplishments over four decades. These include the first nuclear power generation of electricity; the design, development, testing of prototypes of reactors now operating throughout the world; the development of the nuclear navy; the pioneering and advancement of nuclear reactor safety; developments in the reprocessing of nuclear fuel and alloys contributed -- contributions to medical, environmental, industrial, and agricultural research and many other notable achievements.

Idahoans are keenly aware of the challenges and opportunities which will be presented by the new space nuclear propulsion program. We are solidly committed to a continuing partnership with INEL and the United States Air Force to ensure the success of this important project. We believe our national security interests and the cause of world peace are best served by United States leadership in space exploration.

Idaho has long been a leader in the development of

peaceful uses for the atom, and our citizens are eager to play a key role in the development of yet another peaceful use of nuclear energy. Thank you for the opportunity.

THE HEARING OFFICER: Thank you, Mr. Kenny. After Mr. Mahoney speaking for State Speaker of the House Tom Boyd and then himself will be State Representative Jack Barraclough.

MR. MAHONEY: Thank you, Col. Heupel. On behalf of Speaker Tom Boyd I wish to welcome the Air Force to eastern Idaho. And I'm speaking to you on behalf of Speaker Boyd and also myself. I am also a member of the Idaho House of Representatives and a businessman here in eastern Idaho. I will read Speaker Boyd's letter for the record. Then I will put it in the basket, sir.

E 13.1

Dear Colonel: I give my full endorsement to the space nuclear thermal propulsion technology development program established at the Idaho National Engineering Laboratory in Idaho Falls. The performance and staff support at INEL have a long history of success. Your program will benefit from efficient professional attitudes that are top priority with our people. Couple this with the infrastructure that is in place, and you have a winning combination for the Air Force, the project, and the people of this nation. Colonel, I encourage the Air Force to consider the favorable resource that INEL presents to the Air Force.

And speaking as CEO of Atlas Mechanical, Incorporated, with manufacturing facilities in Idaho Falls and Pocatello, I have a long history of activity at INEL for thirty something years, twenty-five years of which I have been a private sector contractor and manufacturer and can assure you that we have one of the most highly trained and dedicated work forces in the nation and have consistently brought in projects on time and within budget.

The INEL has forty years excellent experience in nuclear testing, safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing, and safety. These technical skills are necessary for the U.S. to have the space nuclear propulsion program.

Additionally, the INEL has many of the facilities in place that would support the SNTP, including missle assembly building, hot cells for the examination of materials, excellent lifting facilities for handling large equipment, and a topnotch transportation system. The majority of our citizens in this area have been and continue to be supportive of the INEL, as are a majority of my colleagues in the House of Representatives.

Again we would urge you to favorably look on INEL as the site for this probject. Thank you.

THE HEARING Officer: Thank you. Am I close on

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Barraclough?

MR. BARRACLOUGH: Barraclough.

THE HEARING OFFICER: I'm sorry. After Mr. Barraclough will be Edith Stanger, Bonneville County Commissioner. Yes, sir.

MR. BARRACLOUGH: I'm Jack Barraclough, Col. Heupel, Idaho Falls hydrologist for thirty-five years with the U.S. Geological Survey and currently eight years with EG&G-Idaho and a newly unopposed representative-elect of the Idaho House of Representatives.

I've studied the INEL environment most of my life from day one with a ten year time off to go to Florida and work, and especially the effects of INEL on the subsurface. I worked on a number of projects with the Air Force which demonstrate both from Florida to California -- which demonstrate that the EG&G INEL family can work successfully with the Air Force in bringing in projects in waste management and cleanup.

For the past five years I've served on a panel evaluating radionuclide migration at the Nevada Test Site. So this gives me some experience in the environment that is able to compare both sides.

In 1948 a hundred twelve sites in the United States were evaluated to find the best place to develop and test nuclear reactors. INEL was selected. And the only

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thing that's changed -- because of it's natural advantages -- since that time is we've developed a lot of successful reactor people and numerous support facilities, and we're slowly winning over the support of the state because we're defusing the environment issues, that when they compare INEL with the rest of the county they find that our contaminants are mostly at or below today's drinking water standards, and within a year they'll be below drinking water standards.

So hopefully now new projects will be judged on their merit, not on waste disposal practices thirty or forty years ago.

INEL has one unique method of discharging -- an alternative to discharging radionuclides to the atmosphere. In 1964 to 1968 we made extensive tests of the underground injection of gas and associated tracers. Th[illegible]ing was -- was taken place -- took place just about a [illegible] south of the proposed facility. We injected one mi[illegible] feet of air traced with one thousand curies of zenon [illegible]oactive gas with a half-life of 5.3 days and watched the effects in a month and put this into a permeable zone a hundred twenty feet below the surface and eighty feet above the water table. And almost all the gas remained in place. Just a small amount came out into the atmosphere.

And so this -- if this were desired in the future, the test setup is already there with instrumentation wells

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and this could be utilized for something like underground gas injection.

Concern has been given about the flooding of the project because it's located in the Birch Creek playa. The playa is both the terminus of the Big Lost River and Birch Creek. However, the playa has not received water from both streams since 1894. And since then the Big Lost River is controlled by storage and diversion facilities which greatly minimize the flooding potential. And Birch Creek is a very unique stream. It has the most uniform stream flow of any stream in Idaho. It has no tributaries, and all the snow melt seeps into the giant alluvial fans and comes out as spring flow in the spring in Birch Creek.

And usually there's only a hundred cubic feet per second difference in the high flows from low flows to show how uniform it is. In adddition, Birch Creek is diverted away from the playa for irrigation and hydropower generation. We did have some flooding in 1969 at Test Area North because of a high snow pack, frozen ground, and a rapid increase in temperature. But because the facility at the Test Area North is located about ten feet above the playa floor the facility was not -- the Contained Test Facility did not flood at this time. In fact, there was about six feet of free board in this very severe flood.

I've looked at the earthquake risk of both -- both

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for Nevada Test Site and INEL, and they're both in zone Two-B. And ten years ago we were successful because of our extensive studies at INEL in lowering the seismic risk zone at INEL. And although they're both in the same zone, the earthquake risk is somewhat lower at INEL because of other studies that have shown this.

Test Area North was developed for the aircraft nuclear propulsion project, the atomic airplane, and was also utilized for the systems for nuclear auxiliary power testing and development. The area is well equipped for the return of the space nuclear development.

F 13.1

And I strongly support the location of this project at INEL. The project in my judgment will not cause any significant environmental concern for eastern Idaho. Thank you very much.

THE HEARING OFFICER: Thank you, sir. After Commissioner Stanger will be Boise Mayor Don Robison representing Kirk Kempthorne.

MS. STANGER: Thank you. This evening I come to you wearing two hats. I'm a commissioner of Bonneville County and speaking not only for that office but for the other elected officials of our county.

G 13.3

We strongly support the proposed space nuclear propulsion program. I have a much more familiar one both to me and most of the people that know me here in the room, and it's a cowboy hat. Since the early

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'50s my family, my husband, and I have been neighbors of the INEL. During this time we have raised wheat, cattle, and horses on approximately three sections located on Crofts Road just east of the Site. During that time we've had no reason to believe that the INEL was ever anything but a very good neighbor.

We strongly support the INEL's continuing presence in our community and recognize the need for new efforts such as the space nuclear propulsion program. I would like to add that I appreciate very much being allowed to take part in this democratic process. However, I do believe that we possibly are all in a little more danger from sitting through these long hearings, especially you gentlemen, than we are any of the effects of the Site. Thank you.

THE HEARING OFFICER: Thank you. Mr. Robison.

MR. ROBISON: I'm proud to represent Dirk Kempthorne, mayor of Boise and Republican candidate for the United States Senate. Unfortunately, Mayor Kempthorne was not able to make it tonight due to prior commitments. But he sends his regards.

H 13.1 Dear Col. Heupel: I encourage you to select Idaho National Engineering Laboratory as the location site for the space nuclear thermal propulsion ground testing facility. The goal of the SNTP to allow large satellites to be moved to higher orbits and help meet the future needs for intelligence

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information gathering is forward-looking and laudable. Such a program would be a perfect fit at the Idaho National Engineering Laboratory for a number of reasons. I believe any new mission at the INEL must emphasize public safety and health and protect the environment.

With over forty years experience INEL can meet the challenges put forth by the SNTP program. INEL is the leading nuclear research facility in the U.S.. Over eighty percent of INEL's budget is devoted to vitally important defense projects. INEL would provide the facilities to complete all phases of the program and would also offer an outstanding pool of world-renowned professional talent for the project. INEL offers tremendous experience in safety analysis and environmental quality assurance.

I strongly support this public process. Some concerns will arise, but INEL has an excellent record of successfully working with private individuals and agencies to address potential problems. INEL's past cooperation with the Federal Aviation Administration, Idaho Department of Transportation, U. S. Department of Transportation, and local residents is a matter of record.

Again I strongly urge you to select INEL as home for the SNTP project. INEL's science and safety record make it a key resource for the project's success. Thank you.

THE HEARING OFFICER: Thank you. That covers the

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elected officials. We have some other people that put their names in with the general public or to submit their comments informally. And they've -- I certainly don't mean to demean any of those I ask to do that when I talk to them about major public officials, but I did want to make sure that we would have time for the general public as well. I have a number of cards. And what I intend to do is besides seeing how well I can shuffle -- we'll go to 9:30. Then we'll take a break at about 9:30. That's about twenty more minutes. There's not a problem as people have already done. If you need to get up for facilities or anything else, just go right ahead. Our first speaker will be Jack Barraclough speaking in his own regard --

MR. BARRACLOUGH: No.

THE HEARING OFFICER: Okay. You've already --

MR. BARRACLOUGH: Once is enough.

THE HEARING OFFICER: -- got that done. Okay. Well, you lucked out. Get back to the bottom. Oral -- I apologize on names but Behunin to be followed by Shawn Cunningham. Mr. Behunin.

MR. BEHUNIN: I'm Oral Behunin. I live here in Idaho Falls. I'm the president of the greater Idaho Falls I 13.1 Chamber of Commerce. On behalf of the Chamber I'm here to testify in support of the space nuclear thermal propulsion program locating at the INEL.

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We commend the Air Force in its leadership role in nuclear exploration projects of this nature, and required research and development necessary for their successful J 13.1 accomplishments will pay many long-term benefits. We urge you to consider the INEL as the best location of this project, has many positive attributes. Very quickly those are a strong, dedicated, experienced work force whose research capabilities and the ability to complete tasks given them is well documented; a safety record that is the envy of all the facilities involved in nuclear research; community amenities; schools; recreational facilities; arts and entertainment. Location of this project is not near any large population centers. There's room to grow. Current physical facilities that can be utilized for this project. Perhaps the strongest argument this community and other communities in this region as well as leadership of this state support and welcome you here. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Cunningham will be Dr. Chuck Olsen.

MR. CUNNINGHAM: Well, I am Shawn Cunningham, and I reside at 465 East Packard in Pocatello, Idaho. I'm a graduate student at Idaho State University, and I'm currently working as a contract employee at the INEL.

Being associated with the work going on at the INEL both as an employee and a student, I am aware of the

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great technological leaps currently being made in radiation detection. Unfortunately, sometimes in studies such as this the technology available to detect the radiation far exceed the actual impact to the public.

5 12.52 In the current draft of the EIS percentage values of expected average doses are given. Though the Idaho site seems to present a higher credible accident dose than the Nevada site, approximately a twenty-two percent increase, in real life the small values presented have little or no real impact on the environment and the general public. And the slight difference between the two sites is insignificant. Do not let the recent breakthroughs in detection ability affect the comparison of these sites.

6 12.53 In any analysis of risk for a program we must quantify the likelihood of suspected environmental impact for the program against the benefits society will derive. In other words, not only must we determine an estimate for how likely impact may be, we must also consider how likely the individual consequences of that supposed impact are and how society as a whole will benefit from the parent program.

When the public is asked to participate in studies such as this, such as this one, many times special interest groups impose highly improbable scenarios in an attempt to forestall a program's completion. I applaud the fact that you have not included improbable scenarios in your analysis.

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THE HEARING OFFICER: Thank you. After Dr. Olsen will be Richard Kenny.

MR. OLSEN: My name is Dr. Chuck Olsen. I live in Idaho Falls. I've been employed at INEL for the last twenty-five years. I work for EG&G-Idaho. In my experience at INEL I've been involved in primarily nuclear testing for the last twenty-five years. In looking at the SNTP technology, I think it -- the technology crisscrosses the civilian nuclear space exploration issues as one of the concepts being considered, and although the requirements are somewhat different in terms that maybe the -- for the civilian application, the thrust, the weight, the power densities are not as stringent as for the military application, but on the other hand the lifetime is maybe more stringent. But this facility I think affords an opportunity for -- to be used for both civilian and military applications. And I may also add to that I guess my involvement with testing. Most of the testing I've done, been involved with, has been very one of a kind testing involving fuel failure and so forth. I think when that was done it was done effectively and safely.

And prior to the name of Idaho National Engineering Laboratory it used to be called the Nuclear Reactor Testing Station. So it has a long history of reactor testing. Thank you for the opportunity to speak and thank

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you very much.

THE HEARING OFFICER: Thank you. After Mr. Kenny will be Bill Downs. Mr. Kenny.

MR. KENNY: Thanks for this opportunity to make a personal statement on behalf of the SNTP. I am a resident of Idaho Falls, a parent, and a businessman. K 13.1 I strongly support this program and its location at INEL. I support the program and its siting at INEL for the following reasons -- would be some of the reasons. First of all, I'm convinced of the need for continued research in -- new frontiers are needed to maintain the viability of this nation. And no frontier holds more or greater promise than that of space.

Secondly, the siting here at INEL just by -- because of its track record, and that track record assures me and the nation that the R and D and testing will not only be done safely and with high regard for the environment but on time and within budget.

Three, INEL is supported by a consortium of universities that have worldclass staffs and graduates. Along the I-15 corridor or close to it there are many great universities. On the south starting with Bringham Young University and up on the north ending with Washington State and Eastern Idaho University -- Eastern Idaho -- Eastern Washington University. There are also a number of quality technical colleges.

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And, fourth, there is an enviable record of space nuclear environmental projects that have been successfully completed in this area. These successes include those private industries such as Hercules and Thikol, higher education initiatives such as that at Utah State University, Idaho State University, and the collaborations between the University of Idaho and ISU.

There have also been a number of very enviable successes in the DOE sector with a number of things that have been done here at INEL. Thank you very much.

THE HEARING OFFICER: Thank you. After Mr. Downs will be Tommy Walrath. Mr. Downs.

MR. DOWNS: I'm Bill Downs. I'm a senior reactor experiment engineer at the Advanced Test Reactor who's recently -- after several tiger teams have been through the DOE facilities we came out on top. But more important than that is that I'm a neighbor to the INEL. I live south of it. I live close enough that with very little effort I can see whether the plant is operating, whether it's a good day or a bad day to go to work.

But what the INEL has provided me and my family -- we have a very large herd of antelope in our area. If you were to come and visit me, I would have to take you and show it to you. I've had a four point deer in my very front yard. And I attribute this because INEL is a great refuge for

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wildlife. A neighbor of mine says he's currently feeding seventy-five head of elk and due to the INEL. So I can -- what I'm trying to point out is that environmentally the INEL is -- I don't see it as a big impact. It's helped us a lot.

There's several geologic, what, sights to be seen. With a little help from DOE security I've been able to take my family to see a very large cave right there between the twin buttes. There's a lot environmentally that the INEL has provided for this area of the state. And I don't see what you can do to hurt it in such a remote area. The wildlife seem to like the area. The test reactor area has even put efforts into providing surplus water to -- off site for the antelope, deer, and elk to partake of. And those people in Twin Falls, if they're really worried about the water, I have to drink it before they get it, and the department tells me I've got all the hair that I need. So I thank you very much.

THE HEARING OFFICER: Thank you very much. Is Mr. Walrath here? Okay. Apparently not. Then Steve Fogarty to be followed by John Horan.

MR. FOGARTY: Yes. My name is Steve Fogarty, and I reside at 746 East Center, Pocatello, Idaho. I'm a student at Idaho State University. And we believe that support facilities in the area surrounding the project are the best our nation has to offer. Our technical society has always been in support of programs of this nature.

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Our area hosted a recent topical meeting regarding nuclear propulsion. Idaho State University looks forward to the opportunities and possibilities that SNTP project will provide. An environmental program in engineering at Idaho State University has just recently been implemented. This program greatly benefited SNTP. We are currently working towards obtaining a ten megawatt trigger reactor for industrial as well as educational benefits.

We currently have a low power research reactor, and these reactors could be made available for material testing as well as other pertinent experiments. The students and faculty of our university are here to learn and participate in whatever manner needed. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Horan will be Nida Gyorfy.

MR. HORAN: John R. Horan, Idaho Falls. I'm appearing as a freelance radiation protection consultant.

6 Colonel, I hope you leave here tonight with a
13.1 mandate to go ahead with the space nuclear thermal propulsion project and to build it in Idaho.

I'd like to focus on one major point in my
7 presentation. The draft Environmental Impact Statement does not present a fair or complete comparison between the two
1.17 sites. First of all, if you look at the list of the people -- the thirty-four people preparing or contributing to the

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7 cont'd report, the INEL has only two people involved. One of them is Jim Warner, who is sitting at the table there who represented Idaho Operations Office, and then one person -- one contractor person from EG&G, while the Nevada Test Site had one from the Nevada Operations Office and eight people
1.17 from its contractor Sandia. We don't know how many of the remaining people have been former Nevada Test Site employees.

Your contractor, the Earth Technology Corporation, consulted with the Nevada Bureau of Air Quality, Nevada Fish and Game Department, Nevada Wildlife Department, and the Nevada Office of Historic Preservation. In Idaho they contacted only the Idaho Office of Historic Preservation. I realize, gentlemen, you are hard pressed to complete this draft in a very short period of time. I trust you will now take the time to make a point by point equal comparison. And I'd like to give you a few examples of inequities which I have found.

8 A very good summary is presented on the over twenty reactor tests performed at Nevada Test Site in support of nuclear propulsion systems, all of these before 1974. On
1.18 the other hand, the aircraft nuclear propulsion program at the INEL is discussed with the terse comment the ANP program was terminated before an aircraft could be built. Yet the aircraft nuclear propulsion program was remarkably similar in many basic ways with what you're planning to do now thirty

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8 cont'd years later. Over a period of six years this project had three full-scale reactors operating during thirty-one test series. They had one criticality accident, and over seven hundred thousand curies of radioactivity were released to the atmosphere, all of this without significant environmental
1.18 impact.

Neither is there any mention of the destructive testing of two space reactors, the SNAPTRAN (phonetic) ten A and B, in the 1960s. The reason I'm so familiar with these projects is that I was the AEC director of health and safety responsible for environmental control over the INEL during this test period.

9 Let me also add that your selection of model weather conditions for testing favor Nevada, but they are too
12.24 restrictive and could lead to increased exposures in Idaho. No credit has been taken for cloud meandering nor the fact that the same individual will not receive every mini exposure from each test.

10 You have chosen to ignore the fact that the plume from the burning hydrogen can in many cases penetrate into the inversion layer. This would provide larger radioactive
12.77 decay and dispersion, thus reducing exposures off site. This safety approach has been used at the INEL on several occasions since 1959.

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12.54 Finally, no credit has been taken for the LOFT

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11 cont'd 12.54 containment vessel in the event of an accident, although I will say that some reasons for that have been presented here tonight. In conclusion, Colonel, if the playing field were level, the INEL would be the overwhelming choice because of technical support, cost effectiveness, public support, and environmental safety. These are the four basic criteria used for the siting process. Thank you very much.

THE HEARING OFFICER: Thank you. How do you pronounce your name, ma'am?

MS. GYORFY: Nida Gyorfy.

THE HEARING OFFICER: Okay. After Ms. Gyorfy we'll take our break, and before we break I'll announce the following two speakers. Go ahead, ma'am.

MS. GYORFY: My name is Nida Gyorfy. I live at 10648 North 25th East. And that's in Idaho Falls proper but north to the county line. I'm a very involved resident of the community. I am also a wife, mother, and grandmother with a vested interest in the welfare of this area. I live M 13.1 north of Idaho Falls, and I want to express my family's support of the SNTP program being located on the INEL site near Idaho Falls.

We support this program because the Site has forty years experience in nuclear safety testing and already has many of the facilities in place which would support SNTP testing. We, my family, believe that space nuclear

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propulsion would provide longer rocket thrust which translates into cost savings in time and fuel on space missions. Our understanding is that half as much fuel would be required on extended missions. We feel the SNTP will be safe for the environment as any exhaust produced during testing would be put through extensive filtering and cooling systems, and no water usage is planned. Therefore, no liquids could migrate into the aquifer. The INEL has a superior safety record, and we want to go on record as being in support of the SNTP and its location near Idaho Falls on the INEL site. Thank you.

THE HEARING OFFICER: Thank you. All right. Let me ask. Is -- I believe it would be Mark Schell and Jon Ochi -- Mark Schell? Okay. You'll be the first two speakers. Mr. Schell will be first and then Mr. Ochi. We'll take a ten minute break.

(Brief recess)

THE HEARING OFFICER: Mark Schell. Mr. Schell?

MR. SCHELL: Thank you, sir. I appreciate the opportunity to address this audience on behalf of myself as an individual. My name is Mark Schell. I live at 803 Hansen Avenue, Idaho Falls, Idaho. I have been an employee of INEL for the last twenty years. And I've had my whole career here at the INEL. So I have experience with both INEL and the community.

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In your EIS statement and the presentations that you've made you've gone through and made several analyses about the credible accidents. And I appreciate the depth and degree that you went to. Hopefully you will review that, you know, from the draft to the final and include as many of the issues that are brought up here so we make everything a reasonable approach.

One thing I would like to point out to you is that having the EIS statement laid out -- it points out the credible accident scenarios. We may also be able to take credibility for the fact that the capability of the personnel existing safety systems programs demonstrated safety record of the INEL should maybe be considered in the overall evaluation because one shows the risk and one shows the modification of that risk due to the capabilities of the personnel here at the INEL.

The management of the program I feel is a critical issue as well. A well managed program can also considerably have an impact on whatever environmental issues need to be addressed. I think the INEL has taken a forward stance in being a good neighbor, and I think several people have demonstrated that aspect.

But the well planned projects and well laid out projects are crucial, And that planning includes all the environmental aspects as well as all the other aspects that

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are going on.

Capability is here for us to take on these type of projects effectively. The INEL has a long-running track record of successful reactor testing, which has been pointed out before. I have worked at several of the reactor facilities for a number of years. Our safety records are there. Our concern for the environment is there. And I feel that if you bring your program here we will manage it in a manner that will get you the best value for your money. I can also state to you that from a management standpoint INEL is leading in the arena of building a strong core project management group which will take into consideration all of the aspects in addition to the environmental aspect.

We are currently building a project management organization and a training program to develop that type of talent. So that can be brought to your program.

We have extensive computer model capability. We have a very strong geoscience organization to address all the environmental issues that have been brought up. We also have extensive experience in both fusion and fission safety. That allows us again the ability to study these safety issues effectively. And we have the ability to come up with new and creative solutions that may not have been addressed at this point in time.

The INEL has a long track record of advancing the

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science and technology in these areas. I would encourage you to take full advantage of that capability. We've also got a running track record and I've been associated with it and proud to say so with successful completion of several Air Force type projects. One of those was the TAC project that was completed here at the INEL. We took and developed a new Tactical Air Command system using our electronic capability and the people that we have here at the organization at the INEL to build that system and develop it in a very short period of time. We shortened the cycle of development from a normal cycle for the Air Force of fourteen years down to what I believe was around three or four years in development cycle.

We know and understand the Air Force, and I personally enjoyed working with the Air Force; and we look forward to doing so in the future. Thank you for your time.

THE HEARING OFFICER: Thank you. Do you pronounce Ochi or --

MR. OCHI: That's correct.

THE HEARING OFFICER: After Mr. Ochi will be Michael Weeks.

MR. OCHI: Col. Heupel, ladies and gentlemen, my name is Jon Ochi. I was born and reared in Idaho Falls. As a candidate for state representative and as an independent

N 13.1 businessman I support siting the space nuclear propulsion

N 13.1 program at the Idaho National Engineering Laboratory. The purpose of this hearing is to discuss environmental impacts. As a member of the environmental community and as a founder of the Friends of Fall River I am sensitive to impacts to our environment. When our group was evaluating the worthiness of the Fall River hydroelectric project, I frequently asked for help from experts at the Idaho National Engineering Laboratory.

Besides having expertise in nuclear engineering INEL employs mechanical, electrical, chemical, and civil engineers. I can assure you that these scientists are concerned with the environment professionally, esthetically, and morally. These scientists care about maintaining the quality of our environment.

The nonenvironment reasons for siting the project here are numerous. Existing containment and handling facilities, economic benefits of utilizing existing facilities, expertise and environmental monitoring, more experience in nuclear reactors than all other national facilities combined, and public support.

I wholeheartedly support siting of the facility here for if it can be safely constructed anywhere in the world, it would and should be here. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Weeks will be Douglas Rolls. Mr. Weeks.

MR. WEEKS: My name is Michael D. Weeks. I'm an airport operations specialist.

THE HEARING OFFICER: You may need to move it up. Thank you.

MR. WEEKS: Thank you. I'm an airport operations specialist at Idaho Falls Municipal Airport at Fanning Field. I've been asked to represent Mr. James H. Thorson, the director of aviation for Fanning Field. He's prepared a brief statement.

Idaho Falls Municipal Airport is prepared to and capable of supporting Air Force demands for the space nuclear thermal propulsion project. The air field is capable of operating virtually all sizes of commercial and military aircraft, including the Lockheed C5 transport.

The air field is equipped with an FAA owned and operated instrument landing system, has radar service and FAA staffed control tower, flight service station. The air field is capable of fifty-five instrument operations per hour, far in excess of our demand. The air port is served by American Air Lines, Delta Airlines, Horizon Air, and Sky West Airlines.

There is excess capacity in the terminal facilities, and the carriers can quickly add capacity via more scheduling and larger aircraft. Current air carrier service is with Boeing 727 200, 737 300, and the 80 EMB 120,

DeHavilland-8, and Metroliner aircraft. Current schedules comprise about fifteen flights per day with approximately eleven hundred seats available.

In summary, the Idaho Falls Municipal Airport can handle demands placed upon it in support of the Space Nuclear Thermal Propulsion Project. Thank you.

THE HEARING Officer: Thank you. After Mr. Rolls will be Robert Skinner. You probably need to pull it up a bit more. Just turn it at the bottom. Thanks.

MR. ROLLS: Colonel, I am honored that you are here this evening, and I do not believe that there is much

O 13.1 else that I can add that other parties have added except for the fact that I am from California, been here about a year, and I am in full favor of this project. I believe that INEL can handle it and I am a citizen here and I am -- I support it all out, and I hope that taking into consideration everything that has been said here I hope that you will weigh out all the possibilities. I hope you choose Idaho Falls. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Skinner will be Lexi French. Mr. Skinner.

MR. SKINNER: My name is Robert Skinner. I reside at 290 Troy here in Idaho Falls. First of all, I would like to congratulate you on writing a document that is readable. Not many of them anymore seem to be, and it's readable and

understandable to the average person. I would certainly agree with all the previous speakers on the technical capacity and know-how we have at the INEL. The INEL and the Air Force would and have made great teams.

I would like to ask -- and there have not been any nay-sayers or skeptics here, but I'm sure you've heard them in the past. I would like to ask that you weigh their testimonies and their requests carefully and look closely at their technical merit of their questions. I call some of these people what I call the banana people. They have a theory that says build absolutely nothing anywhere near anybody. And so we have to be -- make sure that if there is somebody that has an argument against something that it does have technical merit because we -- those people would have us living in tents and communicating with cans hooked together with strings.

Technology has extended man's span and quality of life on earth. We need to explore new technologies, and the SNTP is a perfect example of a new technology.

You ask for environmental input. Our people are an integral part and probably the most important part of our environment. Students and teachers are the most important part as far as I'm concerned of that environment, and the SNTP project would improve their environment greatly by doing -- and I'm just going to mention a few that I -- I could

write this -- go on forever, but it would spark interest in students in science and technology, and today students think that people that are interested in science and technology run around with thick glasses, lots of pencils, and white lab coats looking for ways to destroy the world. It's just not true. This project would help get that information to students.

We could have space experts working on this project that we can hopefully lure into our schools to talk to the students, would enable educational demonstrations, and the list would go on and on and on. But the benefits to students and teachers and education from this project and improving our environment would be endless.

For the future of our environment and I believe our children, our future environment, I would like to see the space nuclear thermal propulsion project come to Idaho. Thank you.

THE HEARING OFFICER: Thank you. Is Mr. French here?

UNIDENTIFIED: Ms. French.

THE HEARING OFFICER: Okay, Ms. French, I'm sorry. She's not? Okay. Cliff Brady to be followed by Bruce Jensen. This is Mr. Brady coming up if I recall correctly. I mean a gentleman with such fine white hair I could not forget.

MR. BRADY: That's right.

THE HEARING OFFICER: Mine is getting about the same color. Mr. Brady.

MR. BRADY: As a resident of Idaho Falls and a business owner, past president of the Idaho Falls Chamber of Commerce, veteran of the United States Air Force, proudly so, and a citizen that takes a great deal of pride in the people who comprise the work force at the INEL, I know that these people can provide you with the best technical and operational expertise in design, construction, testing, and operation for your space reactor.

They will do it with the utmost concern for the safety and protection of the people of Idaho. In fact, the vast majority of people in Idaho believe that our laboratory is the best run and cleanest of all laboratories in the nation.

Our community knows that the INEL has been a concerned guardian of the environment of this beautiful area here of Idaho without fear and hoping that you will not give equal weight to that vocal minority whose pitch is doom and gloom whose real aim is to hold back the future.

The other night in Salt Lake City one lady got up and testified and made the following statement. She accused the military of having committed genocide on the Japanese people by droping the atomic bomb on Hiroshima. I thought

that was the most dastardly statement I've ever heard. I want you to know that everybody in this room is proud of the fact that you, the United States Air Force, then the Army Air Corps, has the guts, the ability, the determination to do that job to liberate the Japanese people from tyranny and prevent the death of thousands and thousands of our military people. I want you to know that we here in Idaho Falls are proud of what you did with the atomic bomb at Hiroshima. Too bad so many people had to be killed, but the job saved many thousands of American lives. I was really sorry she made that statement.

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13.1 I wish to express my complete support for your program of ground testing of space reactors at the INEL.

THE HEARING OFFICER: Thank you. After Mr. Jensen will be Rick Tremblay.

MR. JENSEN: I'm Bruce Jensen. I reside at 1281 South University in Blackfoot, Idaho. I'm a student at Idaho State University.

12 The draft environmental impact study has mentioned employment of approximately one hundred persons. I would like to remind you the real issue at hand is not how many
4.2 persons will be directly employed by the program. The true issue is how many people will be indirectly affected.

For example, Idaho State University and its nuclear program will benefit substantially from the research

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opportunities presented by performing the SNTP at the INEL.
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I would like to emphasize the indirect persons affected by the SNTP. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Tremblay will be Stephen Watts. Mr. Tremblay.

MR. TREMBLAY: Cols. Huepel, Bleeker, and Baumgartel and Mr. Warner: I thank you for giving me this opportunity. My name is Rick Tremblay. I live in Boise, Idaho. I'm here on behalf of myself and many of my friends in Boise that share the same opinion that I do. We're all proud of The INEL. It is not only the nation's only national engineering laboratory; it's the Idaho National Engineering Laboratory. All of us in Idaho are proud of that fact. We're proud also of the technical contributions that the INEL made to the state, the nation, and this planet. We're also proud of the cultural quality of life contributions the INEL has made to this community and the state, and we're very thankful of the cash contributions the INEL has made to this state. And they are plentiful.

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It's my opinion that the only environmentally
13.1
sound choice for the space nuclear thermal propulsion program is the siting location proposed for the INEL. I say this for
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three reasons, Col. Heupel. First, total containment of this
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project is absolutely necessary for noise abatement, avoidance of killing trees and wildlife, and of equal

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importance is the mitigation of health concerns real or
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perceived by most people living downwind, whether it's downwind of the INEL Site or downwind of the Nevada Site.

Second is the INEL not only offers total containment for CTF at TAN, but the INEL employees, many of the world's leading experts in nuclear reactor operations, testing, and safety, having built as you well know and operating fifty-two reactors over the past four decades. They are the best in the business here in Idaho.

And, third, as we are all painfully aware, public perception of fact can all too often override true fact. This project has received mixed reviews in Nevada and Utah mostly because of downwinders in St. George and Las Vegas. And they have concerns about this operation being outdoors. They don't want an outside operation.

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And again total containment of CTF at TAN, because it would be an inside -- an indoors operation cradle to grave
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would virtually eliminate many of the environmental concerns of the vast majority of people in Nevada, Utah, and Idaho. As an aside, I proudly served the U.S. Air Force Strategic Air Command from 1964 to 1970, and I for one would welcome a permanent presence of the U.S. Air Force here in Idaho, the state of Idaho and Idaho Falls. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Watts will be Arnold Ayers.

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MR. WATTS: Thank you, Colonel. My name is Stephen Watts, and I reside in Idaho Falls, long-time resident of Idaho Falls. I'm a retired state criminal investigator and a current candidate for sheriff of Bonneville County. I would like to share -- I'm not going to read my whole statement because everybody has said things I would like to. I would like to share with you -- part of my career has been as a contract investigator with the United States government doing background and special investigations on the INEL site here. As such an investigator I have wandered about freely -- Q-clearance -- the INEL site at every facility out there talking with hundreds and hundreds of people and obtaining information.

And my purpose in testifying today or tonight is that on the remote chance that some crazy banana may have shown up and wanted to talk about the danger of the Site, and I wanted to counter that. Unfortunately, no one has stood up to do that. I can give testimony that it is safe on the INEL site for everyone. I am robbed of the opportunity to refute someone else, but in case someone were to stand up later, this is my refutation, and I appreciate the opportunity.

THE HEARING OFFICER: Thank you. After Mr. Ayers will be Ira Koplow?

UNIDENTIFIED: Koplow.

THE HEARING OFFICER: Koplow. Mr. Ayers.

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MR. AYERS: Thank you. My name is Arnold Ayers. I live at 1340 Washburn, Idaho Falls, Idaho. I am an engineer by profession. I am representing, however, myself and speaking my own comments at this point in time. I have lived in Idaho since 1952 -- '51 actually. All of my education and all of my training has been performed within the Idaho Falls and Idaho school system. I classify myself as a near native and have lived here almost all my life in the shadow of the Idaho National Engineering Laboratory and have had no reason to have any doubts or any concerns about any aspects of operation here.

I would like to address a couple of additional issues over and above that. First off, the project that we are doing -- based on a cursory review of the information that was presented, I can envision several methods that can be used for environmental containment of the effluents coming off of that. I speak of that from a background as a knowledgeable person. Since 1972 I've been working in radioactive waste treatment systems, which includes hazardous materials such as explosive mixtures of hydrogen-oxygen, high temperature systems such as would be found on the outsides of -- of incinerators and those types of systems. So I speak from some level of knowledge and suspect that there's probably no reason at all for any concerns why anybody would have any concerns for environmental effluents coming off of

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it, especially the airborne versions there.

The other issue I wish to address is one that is more dear to my heart. It is called the gee-whiz section, okay? I would like to take a look at this project in a historic perspective. A number of decades ago a few people went out and made a small aircraft and flew at Kittyhawk. From that we have developed such expertise as to be able to build such aircraft as a 747, the SR71 a number of -- about a decade or two ago, other aircraft and other -- the space shuttle is one of the examples that has come out of that. In the 1950s and '60s we did testing on rockets such as -- such as the X1 and X2 frm the '40s and developed into the dinosaur project, one of the Air Force projects, a spinoff from the F15 project. Who would have guessed that the technology developed at that time would go into the commercial industry and more appropriately into the spacecraft that came back to us as the space shuttle.

We need projects like this. We need projects like this to maintain and develop our future, not only as a nation, not only as a state, but as a human race. Earth's resources are limited. Space resources are far more available. This becomes a small step in the continuing development of a process that mankind has gone on as it has

R 13.3 developed its technological capabilities, and we need to continue that process. Therefore, I conclude that this

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R 13.3 project and these types of projects are not only desirable; they are essential for the long-term survival of humanity. Thank you.

THE HEARING OFFICER: Thank you. After Mr. Kaplow will be Philip McDonald.

MR. KAPLOW: Most of my comments have already been covered in previous testimony. I appreciate the opportunity to comment down in Salt Lake City, and I appreciate the opportunity to give you additional comments here in Idaho Falls. Thank you.

THE HEARING OFFICER: Thank you. And after Mr. McDonald will be Rocky Deschamps.

MR. McDONALD: I would like to join my neighbors and friends in welcoming you to Idaho Falls. My name is Phillip McDonald. I reside at 2653 South Boulevard, Idaho Falls, Idaho. I'm an employee of the INEL. I'm an engineer. I'm speaking for myself. I would like to first just briefly comment as others have this evening that I strongly believe the U.S. -- United States needs space nuclear propulsion for both defense and exploration. SNTP provides significantly greater thrust with lower weight cost. You've talked to that point. Thermal fuels limit the range of our activities in space. They subject our astronauts to significantly greater cosmic radiation, periods of weightlessness. SNTP will increase the speed of our space travel. It will shorten our

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flights and will reduce the costs. It will reduce the weight we have to carry.

In addition, as has been talked about tonight, space travel will stimulate science and technology, science and technology invention, innovation, science and technology education in the United States.

S 13.1 I would secondly like to address the issue of where you do the work. As you might expect, I strongly support doing the work at the INEL because I firmly believe the cost to the U.S. taxpayer and the environmental impact will be less if you use the existing facilities at INEL rather than build entirely from scratch in the desert down in Nevada.

What existing facilities -- we talked about some

15 9.4 of that tonight. We have the Contained Test Facility, a rugged, two inch thick steel containment building, which, by the way, I don't believe is an historical artifact. I might comment that the reactor that used to be inside that building and its associated equipment might have been an historical artifact since that is what was used to simulate accidents in light water reactors. However, that reactor has been removed and disposed of. The containment building itself was not a simulation of anything and was not the subject of any of the tests that were run there. In fact, it was never challenged because our tests were controlled tests, and they never got

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out of control.

We have the TAN hot shop. That's the largest operating hot cell in the west. I'm not sure what's in the Soviet Union, but I know it's the largest in the West. It will take large trucks. It will take double rail railroad cars. We've torn down whole reactors in that, and, of course, as you know, attached to the hot shop are numerous hot cells filled with all kinds of equipment for examining irradiated materials. We have the double wide railroad and the flat cars which make ideal -- which is an ideal way of running your test, putting your test rig on the rail car inside the contained facility and then moving it after the testing of the hot shop for disassembly. We have the assembly building. We have machine shops. We have offices. We have a bunker control room. We have water. We have paved roads. We have power. We have sewer. We have engineering staff. We have public support. We would love to have your business, and we look forward to working with you. Thank you.

THE HEARING OFFICER: Thank you. Am I close in the way I pronounce your name?

MR. DESCHAMPS: You're excellent, excellent.

THE HEARING OFFICER: After Mr. Deschamps will be C. E. White, Jr.

MR. DESCHAMPS: I appreciate the opportunity to

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address you this evening. A couple of things that I would like to address, most of which -- again as Mr. Ira Koplow has said, has already been addressed. I appreciate your comment as far as our banners that we had. We have tried not to display them. However, I would like to make one comment on these banners. As we handed them out this evening, we had five hundred banners that we tried to pass to every person. Of the five hundred we gave out approximately three hundred ninety -- that's -- it's a pretty rough guess. As far as we know, there were six that would not take the banners from us. So we think that's a pretty indicative statement that represents what's happening in this area.

Again my name is Rocky Deschamps. I live at 690 North Eleven Hundred East in Shelley, Idaho, which is actually Goshen. We -- I represent a business that supplies supplies out to INEL. We do a lot to the businesses out there. This area is one of the areas that is very equipped as far as contractors with NQAY requirements. They know the requirements, which is one of the requirements I'm sure that would be met with the facility that would be built here. They're familiar with that. They know of those requirements.

The other thing that I would like to mention is that -- it has to do with these same hearings. We hear all the time that all they -- all -- when have these hearings, all we hear are negatives. We have protesters in all of the

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areas that we have these things in. What you've heard here

T 13.1 in Idaho Falls have been very positive. It would a very flawed process if this facility was not located here, because we have shown you that we support this project. And we're

very supportive of it. We've not shown any negative. And again we hear negative -- everywhere you hear on these processes. We support this wholeheartedly. Thank you.

THE HEARING OFFICER: Thank you. After Mr. White will be Stephen Watts.

MR. WATTS: Stephen Watts alread spoke.

THE HEARING OFFICER: I must have gotten it out of sequence. So Darrol Gardner will be next. Thank you, Mr. Watts. You're right.

MR. WHITE: I'm C. E. White of Idaho Falls, late of Salt Lake City also.

THE HEARING OFFICER: I remember.

MR. WHITE: I'm sure they were not downwind from us. My background goes back to 1956 in nuclear projects. In the good old days of watching I guess a dozen or more of them from behind bunkers, in the air, and what have you, commercial reactors through other projects with the naval reactors here at the Site, also with the NERVA (phonetic) project down in Nevada. So when I talk about the environment and facilities, I feel that I know pretty much what I'm talking about.

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And I believe that the EIS really adequately assesses the program and that it shows the INEL to be a good place for this thing. We have the space. It is government-owned land, and it does not have any archelogical

16 9.1 sites as far as we know. We don't have any Indian tribes claiming the land, which they rightly do in Nevada. I mean that's part of the treaty whether anybody likes it or not.

We -- anything that's done in this project would not in any way as I can see it from going through cover to cover your EIS would in any way contaminate the air, the ground, or the water quality. And if there is an impact on wildlife, it would certainly be negligible, because, as one of the other gentlemen pointed out, we have beautiful herds of antelope and everything else out there. It's just great.

One of the basic things which we believe make our site the prime spot is that we have virtually a total containment facility, as has been pointed out also, to completely encapsulate this test. This will contribute magnificently to any environmental impact. It will keep it from happening because everything is inside. I think somebody said the term cradle to grave. This is true. I refer -- I refer to -- I'm referring to a facility that others have too where the LOFT program took place at TAN. The INEL has been the home of just about every major reactor development including the power generation ones and the ones

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for the naval reactors.

INEL has the best safety record of any -- any -- of the national laboratories. Plus we believe the technical people here -- we have just about the best that you can find anywhere in the country. We have community support for the project, and we would welcome it and its technology to our

U 13.1 area. And in a word I would just say put it here and take full advantage of all we have to offer. Thank you, Colonel.

THE HEARING OFFICER: Thank you. After Mr. Gardner will be John Kester. Mr. Gardner.

MR. GARDNER: Colonel, my name is Darrol Gardner. I live in Iona. I'm a candidate for the state legislature and a member of the Idaho Falls Chamber of Commerce and the INEL Committee. I'm also the vice-president of Sundown Ranch, Incorporated, and we own a nine hundred sixty acre farm approximately ten miles from the east boundary of the INEL. This farm is watered from a six hundred foot well in the aquifer that, of course, runs under the INEL. I've been eating potatoes from this farm for thirty-five years, and I haven't started to glow in the dark yet. I consider that INEL has always been a very good neighbor. We haven't had any boundary problems or -- when you have stock like we have had over many years back in the days when we had several sections out there wandering, it's always been a good neighbor. And the navy folks that have been here in town

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have always been real good neighbors. And we would sure welcome the Air Force here in this community also. Thank you very much.

THE HEARING OFFICER: Thank you. After Mr. Kester will be Keith Jensen.

V 13.1

MR. KESTER: Thank you for your time. My name is John Kester. I live at 3375 Cobblestone Lane in Idaho Falls. I'm here as a private citizen. With tight national budgets and the need for performing quality work at a competitive price I feel the INEL is the best location for the space nuclear thermal propulsion or SNTP program. The INEL has over forty years of experience in nuclear safety testing and maintains a staff with worldwide recognized expertise in nuclear rocket design, testing, and safety of those tests. These same skills are the technology necessary and available for the U.S. to operate the SNTP program.

The SNTP is needed for testing new and advanced space nuclear propulsion concepts and technologies. Nuclear propulsion provides sufficient rocket thrust, and short mission times have been discussed by others. I won't dwell on that. But it is also a cost saving to the taxpayers, and taxpayers in my mind are also part of the environmental impact.

The INEL is the DOE's lead lab for nuclear propulsion systems. For deep space probes and manned

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missions it seems a natural fit in that the INEL organizations could assume the role associated with the SNTP program. Regardless of the jobs that could be provided -- and I believe the extra jobs from the SNTP are just a plus for our local area.

Another reason the testing should be conducted here is the number of facilities already in place that have been discussed, the Contained Test Facility being located well away from population areas and the public and environment, any hypothesized release of radioactive materials.

The fact that the facilities are here, the roads are here, the positive environmental impact on the area. Overall the existing INEL infrastructure represents the facilities for the SNTP. The test preparations, the testing itself, post-test analysis and disassembly, and the processing of radioactive materials for future reuse or disposal. Since all phases of the program can be done here at INEL, it would minimize transporation -- transporting radioactive materials on public highways and having the buildings, the roads, and the equipment and the people already assembled to support the full range of activities also is a minimization to any environmental impact.

All of these recent points are also taxpayer savings in initial costs and in time to do the test phase

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compared to other potential sites where work would have to start from scratch. Locating the program at the INEL is certainly a win-win situation for the area. It offers broad economic benefits to the region including jobs for all level of INEL employees, but also for the community and the state as spinoffs in communities support jobs.

The program means a broad increase in property values, increased tax revenues, and I think a high probability of influx of other space-related industries with an expanded DOE mission for the INEL. INEL is the county's best location to conduct the ground testing program and I believe -- I would offer my support for your program. Welcome you here. Thank you.

THE HEARING OFFICER: Thank you. Keith Jensen? Apparently not. James Okeson or Okeson? And then Anthony Zuppero.

UNIDENTIFIED: He had to leave. He submitted a written statement.

THE HEARING OFFICER: Okay. Thank you.

MR. OKESON: Colonel, my name is Jim Okeson. My residence is 283 Brookside in Idaho Falls. I was born and raised in Boise, Idaho, and have been a registered Idaho voter for all of my adult life, although my service as a nuclear submarine officer for twenty-seven years has often caused me to have to vote by absentee ballot. I have lived

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in Idaho Falls for six of the past eight years and currently am the manager of EG&G-Idaho. However, the comments I make tonight are my own observations and opinions and do not represent those of either EG&G or the Department of Energy.

I need to make another comment about one of the statistics. The comment was made there were six people who rejected taking one of the banners. Recognizing the ground rules, I was one of the six that did not take it. I clearly support the INEL. I believe -- but I think you need to keep that in mind so that statistic doesn't get too skewed. So I reduced it by sixteen percent.

I believe -- I believe the Air Force must consider at least two EE's in this environment -- in this EIS. Not only the environmental E but also the economic E. In this period of increased demands on federal funds which currently exceed all revenue sources, it is clear to me that the two E's must be inextricably linked together.

With respect to the economic E in this period of tight national budgets the INEL has the existing infrastructure, which has been discussed already here, and I won't go into great detail here about the capabilities of the Contained Test Facility. Phil McDonald has outlined those very well, and others have also.

I think it's important to note though that we do have all the facilities to test preparation, post-test

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analysis, disassembly, processing of radioactive materials for future reuse or disposal. And since all phases of the program can be done here at the INEL, transportation of radioactive materials on public highways would be minimized.

Because we have the technical team and facilities needed to make the program successful, testing can start sooner and cost less at the INEL.

With respect to the environmental E, we Idahoans are concerned about our water supplies, our clean air, and preserving our natural resources. It appears the Air Force has closely evaluated the potential impact of this project in the EIS. I understand that the SNTP program will not affect the quality or quantity of this areas's water supply. The rate of water usage for the program is less than twelve acre feet per year, which is the way we irrigators talk about it out here.

Also the rocket being tested uses hydrogen and other gases as coolant; so no water use is planned in the current testing progress, which eliminates some of the questions we face in the Snake River Aquifer and possible other projects.

The operation of the test facility will not affect the quality of our air, as has been discussed earlier in this presentation. I will not go further into that.

I would like to say -- make one comment here about

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the waste that has been produced in the statistics which you said here that the program may produce up to a hundred sixty thousand cubic feet of low level radioactive waste. As you noted, the site's low level waste disposal area has adequate capacity to handle this waste. However, I think it's important to point out to you that the INEL has a very aggressive waste minimization and pollution prevention program which can potentially significantly reduce the generation of this waste. As a matter of fact, people talk about cradle to grave. You've heard that phrase. We here go from birth control to grave, meaning we do everything we can to prevent it to start. I think we can bring some good ideas to bear.

As a taxpayer and as a citizen of Idaho I have suggested the Air Force carefully consider two E's -- the economic as well as the environmental. I would invite you to also recognize the considerable skills of the INEL work force and the engineering experience that they can bring to this project. Falling back to my navy experience, the battle

W 13.1 efficiency E went to the most proficient ship. I would say to you that the INEL presents not one but five E's for the Air Force to consider: the environment, the economics, experience, the en ineering, and, as you've heard tonight, the enthusiasm. Thank you very much.

THE HEARING OFFICER: Thank you. Let me ask:

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have Lexi French or Keith Jensen returned? Or Steve Fogarty?

UNIDENTIFIED: Steve Fogarty spoke.

THE HEARING OFFICER: He's already spoken. Bill Downs?

MR. DOWNS: I spoke too.

THE HEARING OFFICER: Okay. I've got one card left. John Tanner. Mr. Tanner is here. Now, has anybody submitted a card that I haven't called? It appears Mr. Tanner is the last speaker.

MR. TANNER: All right. I'll be the cow's tail here. I live in Idaho Falls. I'm representing the Idaho section of the American Nuclear Society. We are glad to have this opportunity to express our views. The IANS is an organization of nuclear scientists and engineers in Idaho and Utah with membership exceeding fifteen hundred. We strongly support this project.

Nuclear power is essential for future space missions. The amount of chemical fuel that would be required for large power sources or for propulsion over long distances beyond the moon would impose a prohibitive cost, and the long travel times would require unacceptable exposures to radiation, space radiation.

The INEL pioneering history in nuclear reactor testing has already been noted as well as the many tests on three high temperature reactor cores that were conducted here

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for the aircraft nuclear propulsion program. Also mentioned already is that the INEL is the lead laboratory for the Department of Energy's nuclear space propulsion program, and the fact that the IANS just last month hosted a well attended national meeting on nuclear technologies for space exploration. This was in Jackson.

The advantages of using the facilities already here, the LOFT with its Contained Test Facility, and the several large hot cells, particularly the one at TAN, for

17 9.4 disassembly and analysis have also been mentioned. And, incidentally, we feel that the continued use of an historic facility for its original purpose does not violate its history value. We don't shut down other public facilities once they become old enough to become historic.

X 13.10 We urge that the Space Nuclear Thermal Propulsion program consider including future DOE and NASA space propulsion programs as well as possible future international cooperation in such programs. Avoiding unnecessary duplication of facilities and eventual cost sharing with international partners are necessary in this time of fiscal restraint.

18 6.3 Furthermore, as already pointed out, if this could become a permanent reactor, space engine test facility, the amount of low level waste projected for decommissioning, which is ninety percent of the total, would not happen for a

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long, long time.

Finally, as the region's largest technical resource for nuclear-related issues, the Idaho section of the ANS would like to take this opportunity to offer our services for answering any future technical questions the community may have regarding this program. Thank you.

THE HEARING OFFICER: Thank you. Well, it appears that concludes the public portion of tonight's hearing. Remember, you can submit any additional comments that you would like to submit as long as they are received by October 5th of this year. I know that the panel over there has been rather quiet. They're not accustomed to not having to field assorted -- I better be careful how I say this -- assorted questions. I'll just leave it very neutral. But I'm sure that they are quite happy. We appreciate your enthusiasm. We appreciate your comments and your involvement in tonight's hearing. Thank you very much and good night.

(Whereupon the proceedings were concluded at 10:30 P.M., September 17, 1992.)

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OFFICER'S CERTIFICATE

STATE OF IDAHO)
) ss.
County of Bonneville)

I, Rebecca Myers, certified shorthand reporter and notary public, hereby certify that the foregoing transcript consisting of pages numbered from one to 113 inclusive is a true and correct transcript and record of the proceedings held at the public hearing on the draft Environmental Impact Statement on the Space Nuclear Thermal Propulsion Program held on September 17, 1992.

DATED this 1st day of October, 1992.

(Signed) Rebecca Myers
Rebecca Myers
Certified Shorthand Reporter
Notary Public
Commission Expires: 3/24/93

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BORIS A. BERNSTEIN, P.E.
1319 Monterey Drive
Boulder City, NV 89005

REVIEW COMMENTS
ON DRAFT ENVIRONMENTAL IMPACT STATEMENT
SPACE NUCLEAR PROPULSION PROGRAM

6.1 1 1. The major shortfall of this report is lack of discussion on the disposal of the reactor cores upon completion of testing. It is concluded from the text that up to ten 200 mw (PIPET) and ten 2000 mw (GTA) reactors may be involved. The cores will be extremely radioactive with fission product inventories as tabulated in Appendix Tables B-3 and B-4 and must be treated with utmost care and caution.

3.5 2 2. The predicted personnel requirements of 100 during peak construction and 70 to 120 during test operations is unrealistically low. My experience as Facility Operations Manager of Engine Test Stand No. 1 (ETS-1) during the Rover project nuclear rocket testing at Jackass Flats tells me that the involvement of ten times that number of people would be required.

6.21 3 3. The EIS presents information on the amount of nuclear waste expected to be generated:

- 1.6 million cubic feet of low level waste
- 70 cubic feet of mixed waste
- an undefined quantity of unstable (radioactive) transuranic elements (TRU)
- and over a ton of highly radioactive core material.

This is a far cry from the "few grams" of radioactive waste that the public was told in press releases and interviews during the period of April 3-8 of this year.

Not related to the EIS, but of great concern to the tax paying public is the question of cost. Various cost figures have been presented without too much consistency. The latest, as reported in the August 14 issue of the Las Vegas Review Journal, is stated to be $150 million in addition to the $130 million already spent. This is a ridiculously "low ball" figure! The engineering, construction and qualification testing of the Effluent Treatment System (ETS) alone can easily run in excess of $10 billion. The task to which this system is put is mind boggling. As a primary containment its function is to separate and contain 99.9% of radioactive gases and 12.5 4 particulates from the reactor exhaust. The design and construction of this system must, as a minimum, meet the standards set forth in the Code of Federal Regulations 10 CFR 50 for nuclear facilities.

13.4 A It is for the above reason that the stated option of not to proceed with this project must be exercised.

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-8-92.

12.4 1 Opponents refer to unscientific fears of nuclear emissions from a test, I suggest you expand on containment technology and the absence of contamination in a successful test.

Name Gary Scrutan

Address 300 Yosemite St. Las Vegas, Nevada 89107
Street Address City / State / Zip Code

Please hand this form in or mail to:
[illegible]
Attn: Capt [illegible]
Brooks Air Force Base, TX [illegible]

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CITIZEN ALERT

P.O. BOX [illegible]
RENO, NV
[illegible]

P.O. BOX [illegible]
LAS VEGAS, NV
[illegible]

BOARD OF DIRECTORS
[illegible]

STAFF
[illegible]

TIMBERWIND– THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM

Timberwind is the classified name given to a revitalized nuclear powered rocket program. The program is now called Space Nuclear Thermal Propulsion Program. It resembles a prior nuclear rocket program, called NERVA, that was tested at the Nevada Test Site and was cancelled in the early 70s.

Originally a so-called "black budget" project, Timberwind was exposed to public light through the Freedom of Information Act in April, 1991. The Federation of American Scientists revealed the project, which had been budgeted at $10 million a year for several years. The original project was designed to lift super-heavy chemical lasers into orbit as part of the Star Wars (SDI) program. Conventional rockets do not have enough 'thrust-to-weight' ratio for the payloads planned by the Star Warriors.

The original Timberwind proposal had testing components on the ground and in sub-orbital flights around Antarctica. The ground-based test facility is aimed for either the Nevada Test Site or Idaho National Engineering Lab. The Environmental Impact Statement (EIS) process currently being pursued deals with the location of the ground-based facility.

The centerpiece of the nuclear rocket is a Particle Bed Reactor (PBR). This reactor design is composed of small grains of uranium placed in frits so that hydrogen can flow through the reactor much like water through sand. The heated hydrogen is forced through a nozzle to provide thrust for the rocket. The uranium particles are covered with a sealant to prevent a chemical reaction with the hydrogen.

RADIATION RELEASE TO THE ENVIRONMENT

The hydrogen will become irradiated in passage through the reactor. As a result the Air Force proposes to build an effluent treatment system. Even with the effluent treatment system, some radiation can be expected to be released. The Draft EIS proposes to keep the level of exposure to 2 mrem a year.

Nuclear waste will be generated through the effluent treatment system (i.e. *debris traps, filter media, and adsorber beds*). The decontamination and decommissioning of the test facility will also produce large quantities of nuclear waste. The Draft EIS proposes to dispose of the low-level waste at the Area 5

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waste facility on the Nevada Test Site.

POTENTIAL FOR CATASTROPHIC ACCIDENTS

The particle bed reactor was developed at Brookhaven National Laboratory, N.Y. A subscale reactor was built by Babcock & Wilcox, and at least one test was conducted in the mid 1980s. However the reactor shut down after only 24 seconds due to blockage of flow channels. A blockage of flow in a full-scale reactor could lead to a melt down or explosion.

In addition to potential problems with the reactor, the hydrogen fuel is highly volatile. A hydrogen explosion could spread radioactive debris across a wide area.

ENVIRONMENTAL IMPACTS SPECIFIC TO THE NEVADA TEST SITE

The area targeted for the facility is known as the Saddle Mountain Test Station, or Area 14 and is within the Nevada Test Site.
The only access to the Saddle Mountain Test Station (SMTS) is by gravel road.
Desert Tortoise habitat is found south of the SMTS.
1 Seismic activity can be expected from both earthquakes and any future nuclear tests. The Draft EIS minimizes the earthquake
10.2 hazards despite the recent earthquake at Little Skull Mountain, near Yucca Mountain.

THE ENVIRONMENTAL IMPACT STATEMENT PROCESS

- The current document is a Draft Environmental Impact Statement. It is available at the Las Vegas Library, the UNLV main library, and the Boulder City Library. Written comments will be accepted until October 5, 1992.

- A Final Environmental Impact Statement will be prepared and released in 6 months to a year.

- After its release there will be a 30 day comment period followed by a Record of Decision.

- The Record of Decision may be appealed through a judicial process.

2 - Programmatic Environmental Impacts Statements (PEIS) are being prepared for both the Cleanup and the Modernization of the DOE
1.1 Weapons Complex. As a producer of nuclear waste, and a new program at the NTS the nuclear rocket test facility should be covered by both PEIS. This EIS should be delayed until the PEIS process is completed.

For more information call: Citizen Alert at 648-8982

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-8-92

Sir's,

I have lived in Nevada for 15 yrs, though I have never worked at the Test site, I believe due to all the Testing that has been done there, I see no problem with putting this project out at Saddle mountain.

Thank you for your Time
Sincerly
Louis Loupias

Name Louis Loupias

Address 6262 E. Lake mead Las Vegas Nv. 89110
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCESA/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-8-92

A
13.2 I feel that this project should go forward in the State of Nevada for these (3) basic reasons. 1. For the future of our country as a leader. 2. For the good of the economy of our state & city. 3) For the work force & continue at the Nevada Test Site. We have a work force in place able to handle all parts of this program, the work [illegible] will never be public again. and the need for work

Name [illegible] (William Ross Templeton)

Address 115 Clayton St. Las Vegas, Nevada 89110
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCESA/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/7/92

A 13.3 BASED ON INFORMATION PRESENTED CONCERNING THE DRAFT EIS, THE INVESTIGATIONS SEEM TO HAVE BEEN THOROUGH AND COMPLETE. THE ENVIRONMENTAL IMPACTS ARE WELL BELOW ESTABLISHED STANDARDS AND WOULD NEGLIGIBLY AFFECT FLORA AND FAUNA. THE PROGRAM APPEARS TO BE IN THE NATIONAL INTEREST AND I WOULD ENCOURAGE APPROVAL TO PROCEED WITH THE SNTP DEVELOPMENT.

Name DAVID THOMSON

Address 3036 WATERVIEW DR. LAS VEGAS, NV. 89117
Street Address City / State / Zip Code

Please hand this form in or mail to:
[illegible]
Attn : Capt [illegible]
Brooks Air Force Base, TX [illegible]

Document 11

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/8/92

Stop filling your pockets with the profits your making off testing nuclear rockets. It is obvious the military industrial complex does not care about the environment, the homeless, or education. They care about profit: the research corporations, the arms dealers, the weapons contractors. "Star Wars" costs us more than money, it costs us our environment, the desert tortoise, and money we should be using to feed, house, and educate people. You, who make these decisions care nothing about the future of our planet

Name Daryll Goertz

Address 451 N. Hollis #1075 Las Vegas, NV 89121
Street Address City / State / Zip Code

Please hand this form in or mail to:
[illegible]
Attn : Capt [illegible]
Brooks Air Force Base, TX [illegible]

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-[illegible]-92

A 13.4 I oppose the proposed Nuke Rocket Program. I believe we need to move towards [illegible] energy and a permanent job market in Nevada.
[illegible] research could result in a permanent energy source that [illegible] lead to a permanent [illegible] facility in Southern-central [illegible] that could give us jobs that won't run out at the end of a testing program.

Name SCOTT GALINDEZ

Address 120 [illegible] AVE LAS VEGAS, NV [illegible]
Street Address City / State / Zip Code

Please hand this form in or mail to:
[illegible]
Attn : Capt [illegible]
Brooks Air Force Base, TX [illegible]

Document 13

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-8-92

A 13.2 I BELIEVE THE NEVADA TEST SITE IS THE IDEAL PLACE TO CONDUCT THE PLANNED TESTS.

Name DARYL R. [illegible]

Address 4860 N. [illegible] LANE, LV NV 89129
Street Address City / State / Zip Code

Please hand this form in or mail to:
[illegible]
Attn : Capt [illegible]
Brooks Air Force Base, TX [illegible]

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-8-92

A
13.3 I am all in favor of this Project and would work on it also

Name: James A B[illegible]

Address: 4369 VERONA LV NEV 89120

Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-8-92

I am for any type of SAFE Testing that keeps Qualified And Trainl People Employed in NEVADA.

Name: Ray C[illegible]

Address: 6125 Duchesne Av LV NV 89128

Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Desire copy of Final EIS

Space Nuclear Thermal Propulsion Program

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Date: 9-10-92

My concerns are as many others, for people as well as environmental.
My questions are about EIS.
1
7.1 1. What effect on heating of atmosphere around test site - (will this speed up Green Housing effects)
2 2. Is the EIS on sub-scale or full size Rockets?
2.2 3. What is to become of Rocket engines after usage - in space?
Are we to be rained on by the fall out material?

Name: Rocky [illegible]

Address: 1063 Elm St St George, Ut 84770

Street Address — City / State / Zip Code

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[redacted]

10 SEPTEMBER 1992

1 2.2 ① "...PROPOSES TO CONDUCT VALIDATION TESTING OF PBR TECHNOLOGY." (COVER SHEET)
COMMENT: WHAT IS SPECIFIC CHARTER OF AF: LEO MISSIONS, TURBOMACHINERY, FLIGHT TANKS, FLIGHT MODERATOR?

2 12.0 3 12.0 ② "NO IMPACT THAT EXCEED APPLICABLE LIMITS HAS BEEN IDENTIFIED AT EITHER LOCATION." (COVER SHEET)
COMMENT: NO IDENTIFICATION OF IMPACTS LARGER THAN TOTAL PIPET FAILURE IS COVERED. CASE OF COMPLETE FAILURE OF TWO GIGAWATT ENGINE IS OMITTED. WHAT WILL PREVENT CRITICAL MASS DETONATION AND HOW WILL TECHNIQUE BE VALIDATED?

Document 17

4 "...DEVELOP TECHNOLOGY AND DEMONSTRATE ... PROPULSION SYSTEM...USED TO POWER UPPER STAGE ROCKET. (SUMMARY-ALTERNATIVES)

2.2 COMMENT: EVENTUAL USE OF SNTP IS CRITICAL TO SIZE OF TEST PROGRAM, TO THE FALLOUT AND RISK TO POPULATION. STATE IF ENGINE IS TO BE USED FOR BOOST TO LEO; I.E., TITAN SECOND STAGE AS PREVIOUSLY IDENTIFIED.

5 "TESTS WOULD BE SEQUENCED TO BEGIN TESTING OF MULTIPLE ASSEMBLIES." (SUMMARY-ALTERNATIVES)

1.3 COMMENT: IF TRUE, RATIONALE FOR ABSENCE OF COMPONENT TESTING NEED S IDENTIFICATION AND EXPLANATION. EXAMPLE SEEMS TO INDICATE A GRAVE LACK OF APPRECIATION FOR ENGINE TESTING THAT RUNS THROUGHOUT EIS. ANOTHER EXAMPLE IS THE USE OF "GIGAWATTS" RATHER THAN "POUNDS OF THRUST". INDICATION IS A RELIANCE BASED UPON STATIC POWER PLANT TECHNOLOGY.

Document 17

6 "... MAXIMUM IMPACT CASE: RELEASE OF PIPET CORE FUSION PRODUCTS ... " (SUMMARY-HEALTH)

12.8 COMMENT: DISHONEST. MAXIMUM IMPACT CASE IS FULL RELEASE OF SIXTY-ONE FUEL ELEMENT PRODUCTS INVENTORY.

7 "BROAD MISSION APPLICABILITY" (SECTION 1.2)

2.2 COMMENT: DISHONEST. ENGINE CAN NEVER BE FIRED UNLESS IN HEO OR ABOVE. RECORD FOR DECISION MUST CLEARLY STATE USAGE.

8 "THE DECLASSIFIED EIS ..." (SECTION 1.7)

2.3 COMMENT: STATEMENT IMPLIES THERE IS A CLASSIFIED EIS. IS THERE?

9 "ONE OF THE GOALS OF PIPET TESTING IS TO VALIDATE TEST MARGINS" (ETS)

1.13 COMMENT: ETS MUST BE FULLY VALIDATED PRIOR TO PIPET HOT FIRINGS. DRAFT DOES NOT ADDRESS HOW ETS WILL BE VALIDATED FOR TWO GIGAWATTS.

Document 17

10 "TEST WOULD DEMONSTRATE CONTROLLABILITY AND STABILITY AT FULL POWER, RAPID STARTUP AND SHUTDOWN ... ." (SECTION 2.2.2.4)

12.11 COMMENT: CLASSICALLY TEST ALSO SHOW THE CONTRARY. DRAFT IS TO BE CRITICIZED FOR LACK OF STATED CONCERN THROUGHOUT FOR NOT COVERING INHERENT DANGER ASSOCIATED WITH FIRST TIME COMBINATION OF NUCLEAR PRODUCTS, EXPLOSIVE CRYOGENICS, HIGH PRESSURES, HIGH HEAT, HIGH VIBRATION AND HIGH ACOUSTICS.

11 " ... DESIGN TO ACCOMPLISH ... RADIOACTIVE MATERIALS

12.16 REMAINS IN SUBCRITICAL GEOMETRY ... " (ETS)
COMMENT: HOW IS THIS ACCOMPLISHED?

12 " ... INITIAL SCREENING BEGAN REVIEW OF CONTINENTAL U. S. LOCATIONS" (SECTION 2.5.3.1)

3.1 COMMENT: EXPLAIN WHY SAFE LOCATIONS WERE NOT CONSIDERED?

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13 " ... ETS INCLUDES A PROVISION TO HANDLE LOSS OF A COMPLETE CORE <u>UNDER BOUNDING CASE CONDITIONS PROVIDED FOR ACCIDENT ANALYSES CONDUCTED BY PROGRAM SAFETY."</u> (SECTION 2.2.2.2)

1.18 COMMENT: UNSATISFACTORY. UNDERLINED WORDS ARE WEASEL WORDS AND ARE ILLUSTRATIVE OF THE SAME RATIONALE THAT LED TO THE DEATH OF THOUSANDS OF DOWNWINDERS.

14 " ... SINGLE ONE THOUSAND SECOND TEST AT A MAXIMUM

2.2 POWER LEVEL OF TWO GIGAWATTS." (SECTION 2.2.2.4)
COMMENT: WHAT IS THE MISSION?

15 TABLES E-3 AND E-4

12.17 COMMENT: TABLES NEED TO BE TRANSLATED INTO WHAT IT MEANS TO A DOWNWINDER ASSUMING 99.5% ETS EFFICIENCY AND FULL ETS FAILURE.

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: Sept 10, 1992

The INEL is better equiped — fewer people affected. The neighboring Towns to ARCO are accepting of the nuclear site. Jobs were [illegible] lost at the INEL due to government cut-backs & they need the jobs — financial impact this project would mean.

1 11.1 Question: what about the draught & the project's insatiable thirst?

2 10.1 And, as for seismic & volcanic activity 1983 produced a pretty good quake that did alarm people at the INEL

Name [illegible]

Address 1133 So. 400 W. Hurricane, UT 84737

Street Address — City / State / Zip Code

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Written Comment Sheet

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Date: 9-10 92

I HAVE A GREAT FEAR OF MORE RADIO ACTIVE CONTAMINATION TO SOUTHERN UTAH FROM A

1 12.10 ACCIDENTAL EXPLOSION - I THINK THERE IS A POTENTIAL FOR AN EXPLOSION OF THE HYDROGEN GAS THAT COULD PULVERIZE THE POWER SUPPLY AND CREATE A CONTAMINATED DUST OR AIR BORN CLOUD THAT WOULD OR COULD THREATEN MY FAMILY (CHILDREN'S) HEALTH -

13.4 I AM DEFINATELY OPPOSED TO ANY TESTING OF THIS SYSTEM AT THE NEVADA SITE. PLEASE DROP IT FROM FURTHER CONSIDERATION -

OVER

Name DANIEL CLARK

Address 7[illegible] N 2345 E St George, UT 84770

Street Address — City / State / Zip Code

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Document 19

2 10.2 AS A GEOLOGIST, I FEEL THE POTENTIAL FOR SEISMIC ACTIVITY IN THIS AREA OF THE BASIN AND RANGE PROVIDENCE IS WAY UNDERESTIMATED AS STATED IN THIS MEETING AND STUDY + THIS ENTIRE AREA IS CRISS CROSSED WITH FAULTS AND FAULT RELATED FEATURES ANY OF WHICH COULD BECOME ACTIVE AND GEOLOGICALLY ARE CLASSIFIED RECENT AND THUS POTENTIALLY ACTIVE AT THIS TIME + NUMEROUS SMALL TREMORS ARE RECORDED IN THIS SOUTHWEST AREA EVERY YEAR —

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Date: 9-10-92

1 3.7 Will the tests be conducted when winds are blowing towards southern Utah?

2 3.8 Will radioactive materials be transported outside the testing facilities

3 9.1 The Shoshones say the Nevada Test Site is on their ancestral land. How can the EIS say there is no [illegible] Native Americans who [illegible] poisoned?

[illegible] 1953 [illegible] have been [illegible] [illegible] nuclear destruction for [illegible] whole life. I've known too (over)

Name Sara P[illegible]

Address [illegible] 70 S. 400 [illegible] Cedar City, UT 84720

Street Address — City / State / Zip Code

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many people who have died of strange cancers related to the nuclear testing.

Family, friends, teachers & neighbors die at an increasing rate as we [illegible] southern Utah is the casualty of the "Cold War." We are sick of the brain tumors, genetic defects, cancers & thyroid disorders which plague us. There is hope the testing will stop & we don't want this new project to jeopardize the next generation.

The idea of mounting a nuclear reactor on a rocket is dangerous for all the people of the world. You can't guarantee there will never be an accident. The proposal is like having open air bomb testing at random around the world & in space.

A
13.4 This isn't an acceptable [illegible] and the only sane solution [illegible] stop this project [illegible] [illegible] more than money.

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 10 Sept 92

1
12.11 What if anything is known about the action of high temp. H_2 gas (ca 5000°F) is on the proposed containment materials eg ZrC and graphite?

Are you aware that there is a difference between the terms "validate" and "attempt to validate"? The only way that you can say validate beforehand is if the experiment is no experiment but rather confirmation testing.

Size comparisons such as "55 gallon drum" and "car" (at your presentation) seem better suited to lulling an audience than providing meaningful information.

Name: Karen Mort

Address: 1070 Smoke Tree St (Street Address) St George UT 84770 (City / State / Zip Code)

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 10 Sep 92

The Five County Association of Governments represents locally-elected County, municipal, and school board members in Beaver, Iron, Garfield, Kane and Washington Counties, Southwestern Utah.

1
1.21 The greatest concern regarding the SNTP Program is the lack of information provided to area officials. We would ask that a copy of the Draft EIS be mailed to each County Commission in order to allow a broader review of the document.

2
12.31 It [illegible] a comparison of the testing method proposed for the SNTP Program with testing programs used for nuclear reactors used in energy production, submarines, and ~~other~~ aircraft carriers.

Please mail a copy of draft EIS to the address below. Also send a copy of the Final EIS, when available — Thank You!

Name: Kenneth L Sizemore, Director of Community and Economic Devel, Five County Association of Governments

Address: 906 North 1400 West, (Street Address) St George, UTAH 84770 (City / State / Zip Code)

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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A
13.4 [illegible] the SNTP program!

Date: 9.10.92

[illegible] like health care, [illegible] [illegible] what [illegible] with the public.

Name: [illegible]

Address: [illegible] (Street Address) [illegible] UT 84737 (City / State / Zip Code)

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No
No
No

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

WE DON'T NEED IT!!

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I am a DOWN WINDER
PLEASE LISTEN TO THE PEOPLE -- Date: 9-10-92

I am a mother of 5 children I am concerned for their lives and future health. I have listened to the presentation and am against any form of Nuclear testing. My uncle lived in Cedar City and commuted to the Nevada Test Site until he retired 3 years ago. Last year he
13.4 died of Cancer. I AM NOT EVER IN FAVOR FOR THIS UNNECESARY TESTING
1 I am very upset that there was not any
1.8 Announcement of this meeting to notify the public. I read about it in just todays paper. Are you afraid of our reactions to this issue

Name Sherry Schmalz "CONCERNED MOTHER"

Address 1063 Elm St. St. George UT 84770
Street Address City / State / Zip Code

I'm probably a GONER!

DON'T [illegible]

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Written Comment Sheet

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Date: 9-10-92

I [illegible] [illegible]
To [illegible] much nuclear fallout already.
[illegible] the dubious honor of this
13.4 program if it needs the jobs so much.
I prefer the no action alternative

Name [illegible]

Address 13[illegible] S 400 W [illegible] Utah 84737
Street Address City / State / Zip Code

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Written Comment Sheet

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Date: [illegible]

FROM PERSONAL EXPERIENCE I KNOW RADON GAS CREATES [illegible] IN SOIL WHICH CAUSES LOSS OF BONE MASS.
PRESENTLY I HAVE 2.6% BELOW FIRST PERCENTILE ON BONE DENSITOMETRY IN RIGHT HIP.
LEFT HIP HAD 3 BREAKS 1985 WHICH REQUIRED [illegible] PLATES AND PINS.
OSTEOPOROSIS IS 1½ BEFORE I WILL NOT BE ABLE TO SIT.
TREATMENT HAS CONSISTED OF 5½ YEARS CALCITONIN SHOTS [illegible], 3 YEARS OF DIDRONEL AND 3 YEARS OF [illegible]

Name Mabel M. Brown

Address 1086 Smoke Tree ST ST. GEORGE UTAH 84770
Street Address City / State / Zip Code

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Written Comment Sheet

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Date: 9/11/92

13.4 As a downwinder I am opposed to any nuclear testing.
1 If any testing does occur wait until
3.7 the winds are blowing to the west and not to the northeast

Name Jerry Empey

Address 381 W. 100 S. St. George, Utah 84770
Street Address City / State / Zip Code

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Brooks Air Force Base, TX 78235-5000

Requesting a copy of EIS for SNTP DRAFT + FINAL STATEMENT

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: Sept [illegible]

[illegible] Air Force and the [illegible] have dumped in southern Utah. [illegible] program [illegible] people [illegible] [illegible] [illegible] I have had two friends that died from cancer just a year or two after the [illegible] test [illegible] [illegible] —

Name [illegible]

Address [illegible] (Street Address) [illegible] (City / State / Zip Code)

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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St. George, Ut
Date: 9/10/92

Tonite is the eighth anniversary of my best friends death from as the U of U pathology lab diagnosed "a textbook case of radiation induced thyroid cancer". I'm here for in her memory on this anniversary. You mentioned earlier that this a hearing on the environment. Are not human beings part of the environment? certainly their genocide should be considered in your EIS.

A 13.4 TRUST has been lost in our community w/ similar projects. Our past experiences WILL NOT ALLOW TRUST of the USAF, DOE, NRC and any other government agency connected with the NTS. I have to say "NEVER AGAIN, NEVER AGAIN".

Name JULIE C. MCKOWN

Address 456 ZION PARK BL. PO BOX 100 (Street Address) SPRINGDALE, UT. 84767 (City / State / Zip Code)

Please hand this form in or mail to:
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Wernher [illegible]

Written Comment Sheet

→ Nevada Test Site [illegible] (?)

Space Nuclear Thermal Propulsion Program

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Date: 9/15/92

1 12.11 1) Insure that Zirconium Carbide (or other) coating retains its integrity → [illegible] release of fission products. Insure quality control of coating process.

2 12.18 2) Insure that effluent stream is monitored for isotope releases with feedback to shut-down reactor if releases detected above criterion level. Also monitor air quality at perimeter of site.

A 13.11 3) Finish the job in four years or less so we can proceed with Mars ventures.

Name WALTER U. [illegible]

Address 3440 S. 7[illegible] (Street Address) West Valley City, UT 84120 (City / State / Zip Code)

5) Use NRC and DOE.

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4) Get me a job as Sagan's Health Physicist!

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WOMEN CONCERNED ABOUT NUCLEAR WAR

PEACE LINKS

We Utahns are here again to discuss the Space Nuclear Thermal Propulsion program. We still prefer to call this project "Downwind II" but remember it goes by a pleasant alias "Timberwind."

You tell us this EIS will only consider whether the technology of nuclear thermal propulsion should be studied and tested. Also whether or not to construct and operate a ground test facility (400 million dollars has been mentioned to start the project) and where to locate the ground test site (Nevada appears the favored site). Utah will be downwind again.

The decision whether to build the rocket engine in not part of this EIS. Therefore, we must conclude this is just the beginning of a long drawn-out military/DOE program.

Because of still classified material, the safety and environmental consequences of this project have still not been disclosed to citizens, especially to citizens of the downwind area.

Many of us would like to give an answer to your preliminary "whether" questions - the answer is NO, a resounding NO, to this boondoggle project. The real question is whether there is value to this program.

At this time our world hardly needs to pursue the SDI program nor do we need and I emphasis need to pursue interplanetary travel.

The world we live in today has 40,000 children under the age of five dying each day from malnutrition and vaccine preventable diseases, 100 million street children live on this planet Earth, each year 250,000 young children lose their sight for lack of small amounts of vitamin A in their diet. These are just some of the problems that we should be putting programs and projects together for.

Again we ask you to please get your priorities straight and file this project away for some future science fiction novel.

Rosemary A. Holt
Past President
September 15, 1992

Informed Women Seeking Permanent Alternatives to War

1589 Devonshire Drive • Salt Lake City, Utah 84108 • Phone (801) 582-1275

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Written Comment Sheet

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Date 9/15/92

I am an environmentalist, and I oppose the SDI program.
That being said, I do support pursuing this project.
Environmental safeguards are adequate, in my opinion.
A 13.1 I recommend that the project be conducted at the
INEL (Idaho site) facility.
B 13.11 I question whether 60 tests over 10 yrs is an
optimal way to pursue this project. I suggest you
conduct these tests with dispatch and to get on
with applications.

Name BRYCE JONES

Address BOX 714 SLC UT 84110
Street Address City / State / Zip Code

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: Sept 15 '92

A 13.6 We have thousands upon thousands homeless people who need
shelter right here on the earth - first take care of these
people before exploring space. The amount spent on the
study would have been better spent on our earthly problems.

Name Connie Schreiber

Address 4301 Live Oak Blvd. Delray Beach Fl. 33445
Street Address City / State / Zip Code

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: [illegible]

[illegible] nuclear propulsion
system and I'm still not convinced that the [illegible]
the public interest is [illegible] I'm [illegible] against
A 13.6 the project [illegible]
[illegible] infrastructure needs [illegible]
[illegible] space projects [illegible]
[illegible]
[illegible] in the world are U.S.
[illegible] the west and [illegible]
in [illegible]
and [illegible] by the government. [illegible]
[illegible] for nuclear testing [illegible]
public interest is [illegible]

Name Scott Fife

Address 317 E. [illegible] Ave. Salt Lake City, UT. [illegible]
Street Address City / State / Zip Code
9/11/[illegible]

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Written Comment Sheet

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Date: 9-17-92

A
13.1 I SUPPORT THE PROPOSED CONCEPT FOR TESTING SNTP OR SEI NUCLEAR PROPULSION ENGINES AT THE INEL. THE INFRASTRUCTURE IS ALREADY IN PLACE TO SUPPORT THIS PROGRAM.

1
3.9 I ~~ALSO~~ HAVE A CONCERN WITH THE SMTS TECHNICAL DOCUMENTATION. THE PROPOSAL (TITLE I DESIGN REVIEW) INCLUDES A DIRT ROAD LEADING TO THE SITE. MY CALCULATIONS SHOW THAT ~~FOR~~ A 2000 MW REACTOR FIRING, A 4000 SEC TEST, WILL REQUIRE ABOUT 16,000,000 LITERS (OR 400 TRUCK LOADS) OF LIQUID HYDROGEN (THIS INCLUDES THE H_2 ~~FOR~~ THE ETS). ITS CRAZY TO BELIEVE THAT YOU ARE GOING TO TRANSPORT THOUSANDS OF TRUCKLOADS OF LIQ. H_2 SAFELY ON A DIRT ROAD UP THE SIDE OF A MOUNTAIN. THIS NEEDS TO BE ADDRESSED FOR SAFETY, RISK & COST IMPACTS.

Name PHILIP RICE

Address 2760 TIPPERARY LANE IDAHO FALLS ID 83404

Street Address City / State / Zip Code

Please hand this form in or mail to:
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Brooks Air Force Base, TX 78235-5000

Document 36

Statement by the Idaho Section of the American Nuclear Society

Thankyou for this opportunity to express the views of the Idaho Section of the American Nuclear Society. The IANS is an organization of nuclear scientists and engineers in Idaho and Utah. With membership exceeding 1500, the IANS is by far the largest organization of its type in the United States. The programs and interests of the IANS completely encompass all the technical topics of the space nuclear propulsion program. Only last month we hosted a well attended national meeting on nuclear technologies for space exploration.

Nuclear power is essential for future space missions. The amount of chemical fuel that would be required for large power sources or for propulsion over long distances beyond the moon would impose a prohibitive cost, and the long travel times would require unacceptable exposures to space radiation.

As soon as the United States began developing peaceful applications of nuclear energy, Idaho was selected for the site where most of the nation's reactors would first be tested. Some 53 reactor systems have since been built and operated at the INEL, representing more experience than at any *other single site in the world. Specifically relevant to the proposed project is that 31 tests on three* high temperature cores were conducted here for the aircraft nuclear propulsion program. Presently the INEL is the lead laboratory for the Department of Energy's nuclear space propulsion program.

The IANS looks favorably on the conservative safety and environmental goals set by the Space Nuclear Thermal Propulsion Program. In addition to a strong base of professionals, the INEL has such facilities as the LOFT with its Contained Test Facility, and several large hot cells for disas-
1 sembly and analysis, that can help meet these program goals at a reasonable cost. While we acknowledge the wisdom of using conservative estimates in the Environmental Impact Statement,
6.3 we believe that recent experience and success in waste minimization at the INEL can achieve a substantial reduction in the program's actual low-level waste generation, 90% of which is projected to be decontaminating waste.

2 We urge that in evaluating the suitability of a site, the Space Nuclear Thermal Propulsion Program
1.6 consider future DOE and NASA space propulsion programs, as well as possible future international cooperation in such programs. Avoiding unnecessary duplication of facilities and eventual cost-sharing with international partners seem necessary in this time of fiscal restraint.

Finally, as the region's largest technical resource for nuclear-related issues, the Idaho Section of the American Nuclear Society would like to take this opportunity to offer our services for answering any future technical questions the community may have regarding this program.

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/17/92

1
9.4 The potential concern in the draft EIS of listing of CTS as a historic site due to the loss of Fluid Test (LOFT) facility seems unfounded. I believe the conduct of a successful or even unsuccessful SNTP program would only serve to enhance the historic significance of the CTS.

Name Brent Dixon

Address 2654 Glenwood Drive Idaho Falls Idaho 83404

Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn · Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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573 Bath Ave.
Idaho Falls, ID. 83401-3123
September 2, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX. 78235-5000

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Dear Captain Hartford,

I was recently looking over the Draft Environmental Impact Statement for the Space Nuclear Thermal Propulsion Program at the DOE public reading room in Idaho Falls, Idaho. There is an issue I would like clarification on.

1 On page S-6, there is a table titled Summary of Impacts from Alternatives (Table S-1). Within the Hazardous Materials/Waste section, there is a sub-section titled Radioactive Materials. Under the Saddle Mountain Test Station (SMTS) section, the impact analysis states, "Approximately 18% of existing capacity for storage of low-level solid waste required." Under the Contained Test Facility (CTF) section, the impact analysis states, "Approximately 46% of existing capacity for storage of low-level solid waste required." I don't have any trouble with these numbers but I decided that I would like to see just how much waste this would occupy. This is where my confusion lies.

I assume that regardless of where the facility is built, approximately the same volume of waste will be generated. Using the figures on page 3-15, the SMTS would use up approximately 3,186,000 ft^3 of low-level landfill space (or 159,300 ft^3 per year). This is 18% a remaining capacity (or annual input). However, if you

6.7 use the figures on page 3-17 for the CTF, nothing seems to work out. The CTF numbers for remaining capacity are not given and if the 3.7 million ft^3 of waste already disposed of, and the 11 million ft^3 of waste buried annually are both correct, then the low-level waste landfill volume doubled in the first four months of the year. The 11 million ft^3 of annual input at the RWMC x the 46% gives a whopping 5,060,000 ft^3 per year of expected generation. I realize there are no numbers for remaining capacity or life expectancy of the low level landfill at the INEL, but regardless of how long the landfill is open, the percentages stay the same. For example:

> If the INEL landfill is projected to remain open for 20 more years, at 11 million ft^3 per year, that equates to 220,000,000 ft^3 of space. Multiply that by 46% and you get 101,200,000 ft^3 of space needed. Over 20 years, you have that 5,060,000 ft^3 per year total.

Could you clarify this for me? Is there a difference between disposal and "existing capacity for storage of LLW"? I appreciate any help you can offer.

Sincerely,
Chris [illegible]
Chris [illegible]

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date [illegible]

1 [illegible]

3.8 [illegible] the impact on the [illegible] environment [illegible] Idaho [illegible] nuclear [illegible]

Name Anthony Zeppen

Address 6354 E Sunnyside [illegible]
Street Address City / State / Zip Code

Please hand this form in or mail to:
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Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 40

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 09/13/92

SEE ATTACHED COMMENTS

PLEASE SEND ME A COPY OF THE FINAL EIS.

Name K. STEVE MANERAS (208) 526-0798

Address 366 RANCH DR. IDAHO FALLS ID 83404
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Comments on SNTP EIS

1 1. Inadequate data are presented in the EIS to conduct a complete technical review of the radiological analyses. Key environmental data such as the χ/Q at the receptor locations have been omitted. Data that describe the transfer of radionuclides through exposure pathways are not presented and the reader cannot determine if the analysts used MACCS defaults or some other data source. Data such as inhalation rates, resuspension

12.19 rates, etc. are also not presented. No breakdown of doses by exposure pathway or radionuclide is presented so there is no way to determine which radionuclides are critical to the dose assessment or even if the results are in a reasonable range. *I suggest revising Appendix E to* include enough data for an independent reviewer to duplicate the dose calculations, or referencing a technical report that contains comparable information.

2 2. Information regarding the quality assurance status of MACCS was not presented in the EIS. For example, no information is presented *regarding configuration management*, verification, or validation of MACCS. In addition, verification and validation does not appear to have

12.20 been considered as a code selection criterion, even though these are important indicators of the reliability of the calculations performed by any computer code. I suggest including a discussion of the quality assurance status of MACCS in the EIS, specifically addressing the issues of configuration management, verification, and validation.

3 3. The EIS should discuss, at least on a qualitative basis, the potential

12.21 impacts to critical populations around the INEL such as children.

4 4. In Appendix H and Section 4.12.2 (page 4-37), the EIS uses a value of 7.9E-7 latent cancers/person-mrem to convert effective dose equivalent to cancers. Although this value may be calculated from the data presented in BEIR V, these data are for a single brief exposure of 10 rem and are not applicable to the low doses and low dose rates presented in the EIS. For the doses cited in the EIS, a dose rate effectiveness factor of between 2 and 10 (see BEIR V) should be

12.22 incorporated into the cancer risk estimator *to yield a cancer risk* estimator appropriate for low doses and low dose rates. If a dose rate effectiveness factor of 2 is used, then a cancer risk estimator of 5E-7 cancers/person-mrem can be calculated, which is consistent with the low dose and low dose rate cancer risk estimator derived by the International Commission on Radiological Protection in ICRP-60 and now used in other environmental analyses at the INEL.

5 5. In Section 3.12.2, page 3-55, the EIS has included a value of 92.5 mrem/yr for medical radiation exposures in the dose from natural environmental radiation. First of all, medical radiation exposures are not a component of natural environmental radiation, being neither

12.23 natural nor environmental in origin. Second, a more current and correct value for medical exposures is available from NCRP-93 (53 mrem/yr), which should be used instead of 92.5 mrem/yr. I suggest either changing the title of the section or omitting medical exposures as a component of natural environmental radiation.

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5 cont'd 6. In Section 3.12.2, page 3-55 the value for natural background radiation at the INEL appears to be incorrect. The EIS cites a value of 441 mrem/yr for natural background at the INEL. However, the INEL Site Environmental Report for the years 1988-1990 cites a value of
12.23 350 mrem/yr for natural background in the vicinity of the INEL. If medical exposures are included (see Comment 5) using a value of 53 mrem/yr from NCRP-93, then the total background dose is 400 mrem/yr, not 441 mrem/yr (using two significant figures).

6 7. As discussed in Climatography of the Idaho National Engineering Laboratory, 2nd Edition, the INEL has site-specific curves for
12.24 atmospheric diffusion parameters (σ_y and σ_z). These site-specific curves account for phenomena such as plume meander which should be incorporated to yield a more realistic assessment of radiological doses at the INEL.

7 8. Table E-2 states that a wind speed of 1.0 m/s was used for accident dispersion calculations at the INEL. In other environmental radiological assessments at the INEL, a wind speed of 2.0 m/s is used
12.25 for accident calculations, which corresponds to 95% meteorological conditions. The calculations should be revised to be consistent with other environmental analyses at the INEL.

8 9. On page 4-37, the EIS states that the dose to the MEI excludes ingestion. However, NESHAPs dose assessments performed at the INEL include ingestion doses. Therefore, the comparison of the
12.26 MACCS-calculated doses excluding the ingestion pathway to the NESHAPs standard is inappropriate, because INEL dose assessments include the ingestion pathway. I suggest revising the dose assessment to include the ingestion pathway so that ~~[illegible]~~ a valid comparison to the NESHAP standard can be performed.

9 10. Although test-start acceptance criteria are mentioned in Section 4.12.2, the criteria are not listed in the EIS and their technical basis is not discussed. In addition, an evaluation of the number of hours per year
12.27 that NTS or the INEL meet these criteria are not included in the EIS. This evaluation has a direct bearing on the "time window" within which experiments can be conducted at each site and should be included to provide a comparison between the sites.

10 11. The EIS states in Appendix E, page E-4 that Class D stability results in a more conservative estimate of impacts than Class B or C. While this may be true for a ground-level release, it is not necessarily true for an elevated release, as is assumed in this analysis. In many cases, an elevated release can yield higher ground-level atmospheric concentrations using unstable conditions (Classes A-C) than by using
12.28 neutral (Class D) or stable conditions (Classes E-F), because of increased mixing provided by the unstable stability classes. The degree to which (or if) this occurs is dependent on the distance that the receptor is from the release point.

This also could explain why the MEI at the INEL is located at 125 km from the CFA, an unreasonable distance. If stability classes B or C

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10 cont'd were used in the analysis instead of D, then the MEI would probably be located much closer to the site boundary and higher doses would probably result. I suggest doing a complete meteorological evaluation of both
12.28 sites and incorporating the results into the dose assessments. This will yield a more credible analysis than is presently contained in the EIS.

11 12. In Appendix H of the EIS, a value of 2.6E-7 genetic defects/person-mrem is used to convert a dose to genetic effects, citing BEIR V as a reference for this value. However, based on the data presented in Table 2-1, page 70 of BEIR V, a value of 2.1E-7 genetic defects/person-mrem
12.29 can be calculated, not 2.6E-7. I suggest providing the derivation of this genetic risk estimator. In addition, ICRP-60 recommends a value of 1.3E-7 genetic defects/person-mrem. Since this value is based on low doses and low dose rates, I suggest that it be used instead of the value of 2.6E-7.

12 It is also not clear which dose was multiplied by the genetic risk estimator to arrive at genetic risk. For example, ICRP-60 specifically mentions gonad doses, but it appears as if the EIS used effective dose
12.30 equivalent instead. If effective dose equivalent was used, then the calculation may be incorrect, because many of the organs that are incorporated into the calculation of effective dose equivalent do not factor into genetic risk (there are no gonads contained in the lung, liver, small intestine, etc.).

Document 41

United States Senate

WASHINGTON, DC 20510-1202

Statement by Senator Steve Symms
Regarding the Draft Environmental Impact Statement
for the U.S. Air Force's Space Nuclear Thermal Propulsion Program
(SNTP)

September 17, 1992

Shilo Inn
Idaho Falls, Idaho

The SNTP will provide the Air Force with the capability to move large satellites to higher orbits and may provide a capability to move satellites to areas of conflict more quickly. This would be a very beneficial capability. As our nation reduces conventional military assets, we will increasingly need prompt, high quality, and high quantity means of gathering intelligence information. SNTP could help achieve those goals.

The next natural step for this program is the deployment of the ground test facility. There are many environmental impacts related to this action. Impacts include noise and the disruption of transportation and grazing activities, risks posed by the handling of radioactive and hazardous materials, and treating the effluents and handling the wastes that will be generated by the project. Let me assure the Air Force that Idaho is ready and able to meet all of the challenges posed by these impacts.

A In fact, I believe the Idaho National Engineering Laboratory
13.1 (INEL) is the ideal location for siting the SNTP program. Your final environmental impact statement should reflect this fact. INEL's strong suit is the quality of work that she will produce for the Air Force. Before I explain this assertion, however, I first want to discuss how INEL can meet the challenges posed by the environmental impacts of the program.

PLEASE REPLY TO

[illegible]

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Addressing Environmental Risks:

The noise caused by the testing facility and the amount of land required for siting pose challenges for sister facilities at the INEL and for ranchers who graze cattle on the site. I am confident that INEL can manage these challenges. As a United States Senator from Idaho, I can tell you that INEL management has done an outstanding job of communicating and working with the agencies and private entities concerned about transportation and grazing issues in the past. Here are a few reasons I say this:

> INEL has a cooperative agreement with the Federal Aviation Administration regarding air space restrictions over the site. This will improve air security and has a side benefit of providing an agreement-in-place that can be adjusted relatively easily to address the needs of SNTP.
>
> INEL does a good job of working with the Idaho Department of Transportation and the U.S. Department of Transportation in cooperative efforts to better move the thousands of INEL workers to and from the site each day. This is a challenging problem that requires ongoing attention, but again good relationships exist and agreements can be reached to manage the concerns about ground transportation.
>
> INEL communicates well with ranchers. During the recent and constant attacks on the Department of Energy by national nuclear disarmament and environmental organizations -- something the Air Force has not been immune to -- INEL's assurances and cooperative agreements with ranchers have been handled remarkably well. The people in Idaho whose private sector livelihood would most immediately be affected by the environmental impacts of INEL operations have the confidence to graze cattle right on the site.

As you can see, INEL has a very good record of working with Idahoans concerned about transportation and grazing issues related to the site. On the ground and in the air, INEL is a good neighbor.

INEL also has an extraordinary track record of handling radioactive and hazardous materials. For more than forty years -- since its beginnings as the National Nuclear Reactor Testing Station -- INEL's strength has been in handling a variety of radioactive and hazardous materials safely and professionally. Also, the draft environmental impact statement provides a

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rational perspective on cancer and health risks at the two sites by asserting that "no impacts that exceed applicable limits have been identified at either candidate location."

In recent years, INEL has taken a national leadership role in waste management and environmental restoration technology development. Major achievements and milestones have been met by INEL researchers in development of vapor vacuum extraction, in situ vitrification, treatment of sludges, supercritical water oxidation, and retrievable waste storage systems. I am certain that I've left some things off of this list and I would encourage the Air Force to look carefully at the extraordinary experience INEL can bring to meet the environmental restoration and waste management issues raised by the SNTP program.

Assessing environmental risk should go beyond statistical models and population density charts. Past performance, management experience and quality of work that result in a minimizing of environmental impacts from other facilities and programs should count for something, too. Under this standard, INEL becomes a clearly superior choice.

INEL's Environmental Quality Assurance Advantages

The Department of Defense and the Department of Energy are learning in the 1990's is that the eventual shut down costs for their facilities are much more complex and expensive than was ever expected. Under these circumstances, it makes crystal clear sense to me that you ought to site programs where effective site "cleaners" are. There are many environmental cost and management advantages to siting SNTP at INEL. The final environmental impact statement should recognize this reality.

Also, this factor should offset any advantage seen by placing this program adjacent to an air base. In the final environmental impact statement, proximity to high quality environmental protection talent should outweigh proximity to another Air Force installation.

Another advantage at INEL is the site's experience in safety analysis. The site is known for internationally-recognized safety analysis for not only DOE, but also for the Nuclear Regulatory Commission and foreign governments. They have been leaders in safety analysis technology development in areas from remote welding to supercomputer safety software and hardware.

I couldn't help but notice another advantage for INEL -- the design of the Particle Based Reactor (PBR) seems to be very similar to modular high temperature gas-cooled reactors (MHTGR). Much of the MHTGR design and technology confirmation work for

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DOE's New Production Reactor program was done at INEL. Not only would this pool of personnel talent benefit the development of the PBR, but utilizing that expertise would be another way to minimize the environmental risk posed by the possibility of an accident with the new reactor. This factor should also be addressed by the final environmental impact statement.

Conclusions

The conclusions are obvious. The SNTP program and the ground testing facility for the PBR reactor should by sited at INEL to minimize the most significant environmental risks. By incorporating the comments I've made tonight regarding the environmental impact statement for SNTP, I am confident that Idaho will be the preferred choice in the final record of decision.

Thank you for consideration of my comments and I hope our visitors from the United States Air Force enjoy their visit here in beautiful eastern Idaho.

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I have lived in Idaho for 12 years. I married here and am now raising 3 children here. I plan to stay here. My wife's family is from here, her 5 brothers farm in Bonneville County. My wife and I support the Space Nuclear Thermal Propulsion Program.

I have worked in the nuclear field for 17 years. I spent 5 years operating US Navy Nuclear power plants. I spent 6 years operating the reactor plant and supporting systems at the Loss of Fluid Test facility (LOFT), which is now called the Contained Test Facility (CTF). For the last 6 years I have worked primarily with the Nuclear Regulatory Commission, to review safety-related pump and valve testing programs at Commercial nuclear power plants.

A | I am intimately familiar with the CTF facility and its systems. I
13.1 | believe the CTF is well suited to the proposed SNTP project. I also believe the project will greatly benefit the community, and will have minimal negative impact on the environment or the community.

R. Scott Hartley
R. Scott Hartley 9-17-92
403 Carol Ave.
Idaho Falls, ID 83401

Document 43

Bonneville County Republican Party

[illegible]

[illegible]

A Resolution of the
Bonneville County Republican Central Committee

Unanimously Adopted September 16, 1992

Endorsing the Space Nuclear Propulsion Project
at the Idaho National Engineering Laboratory

Whereas the Idaho National Engineering Laboratory (INEL) is a vital component of the Idaho economy and contributes very significant sums of money, expertise, talent, education and sophistication to our social fabric and economic well-being and

Whereas the Idaho Republican Party platform has for many years spoken very highly of INEL and endorsed its mission in nuclear advancements while encouraging the removal of nuclear waste to a permanent repository and

Whereas Idaho's Republican statesman such as United States Senators Jim McClure, Steve Symms and Larry Craig have and continue to be strong advocates and determined national leaders for the advanced sciences and technologies promulgated at INEL, and

Whereas Dirk Kempthorne, the Republican candidate for the United States Senate and

Whereas Mike Crapo, the Republican candidate for the United States House of Representatives have all strongly endorsed the mission of INEL and the Space Nuclear Propulsion Program and

Whereas our National Republican Party platform continues to affirm the need for a strong national defense while increasing opportunities in our changing economy and

Whereas both the Idaho Republican Party and the National Republican Party platforms acknowledge the need to shift our military focus to managing the peace and

Whereas our Republican President George Bush and Republican Vice President Dan Quayle have given us all the vision to advance man's quest for knowledge by reaching for the stars in a manned flight to Mars and

Whereas the Space Nuclear Thermal Propulsion Project can be performed at the Idaho National Engineering Laboratory in a safe manner while advancing the basic sciences and putting America again at the top as the world leader in manned space achievements

A | Therefore be it resolved that the Bonneville County Republican Central Committee endorses the Space Nuclear Propulsion Project and we encourage those in the United States Air Force and those working
13.1 | on similar projects for the National Aeronautics and Space Administration (NASA), to locate their work and efforts at the Idaho National Engineering Laboratory.

Jerry C. Schrade
Jerry Schrade
Bonneville County Republican Chairman

Document 44

MCCLURE, GERARD & NEUENSCHWANDER, INC.

James A. McClure
Jack N. Gerard
Tod Neuenschwander

801 Pennsylvania Ave. N.W. Suite 830
Washington, D.C. 20004-2604
202-393-0545
Fax 202-393-3558

James A. McClure
United States Senator, Retired

Distinguished members of the Air Force, members of the Idaho Falls Chamber of Commerce, and residents of eastern Idaho:

I regret that I cannot be with those of you gathered in Idaho Falls tonight. Now that I have retired, my wife Louise and I spend most of our time at our home in Idaho and I would very much like to be with you there in Idaho this evening. Currently I am in Washington, D.C., tending to the needs of my small business operation here in our nation's capitol. Be that as it may, I hope this prepared statement will help INEL become chosen as the site for research on the Space Nuclear Propulsion Project.

As many of you there know, I served in both the U.S. House of Representatives and U.S. Senate for 24 years. During all that time I worked to make the Idaho National Engineering Laboratory what it is today--the premier nuclear research facility in the nation.

Now Idaho stands poised to become this nation's premier research center in the use of nuclear propulsion to power man to Mars and perhaps beyond. It is projected that nuclear powered rockets will propel man to Mars in half the time it would take using conventional rockets. Although they will use a nuclear reactor, because of the increased speed, astronauts will be less exposed to solar radiation than if they were to use the slower conventional rocket propulsion systems now available. For this reason, I say go forward with the project.

Shortly after I was first elected to Congress in the 1960's, tests were run in Nevada on the nuclear propulsion idea.

Now, it's Idaho's turn.

I am convinced that the well qualified staff and personnel at the Idaho National Engineering Laboratory will serve the Air Force well. INEL has the facilities, the manpower and the technical know how to make safe nuclear rocket propulsion a reality. As an Idaho resident and one who is still well connected to the political
A leadership of Washington, D.C., including my good friend President George Bush, I encourage the Air Force to go forward with this
13.1 project and to locate the research work in Idaho.

Sincerely,

James A. McClure

James A. McClure
U.S. Senator, Retired

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date 09/17/92

A On technical, environmental, and economic
13.1 grounds I strongly [illegible] the [illegible] of the SNTP & the INEL.

I would like to receive a copy of the EIS as soon as possible. Thank you.

Name Abderrafi M. Ougouag

Address 747 Whittier Idaho Falls, ID 83401
Street Address City / State / Zip Code

Please hand this form in or mail to:
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Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A I strongly endorse the location of the SNTP at
13.1 INEL. I believe the country's financial condition dictates that the SNTP be located at INEL. The facilities and infrastructure exists here and will not have to be constructed. The INEL staff is highly trained and has the experience to bring the project to a successful conclusion, on budget and on schedule. Because of these advantages the testing could be started sooner and cost less than at other locations being considered.

Name ELWOOD R. STROUSE

Address 2762 GALWAY CT. IDAHO FALLS, ID 83404
Street Address City / State / Zip Code

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A
13.1 I STRONGLY SUPPORT THE SNTP AT THE INEL.

Name PATRICIA J. STROUSE

Address 2762 GALWAY CT IDAHO FALLS, ID [illegible]
Street Address City / State / Zip Code

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

INEL has one additional advantage namely: Staff with experience in particle fuel – (Currently working on New Production Reactor Program utilizing High Temperature gas cooled reactor

Name: Hans W. Chi

Address: 2710 Waterford Cr (Street Address) Idaho Falls ID [illegible] (City / State / Zip Code)

Please hand this form in or mail to:
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Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-17-92

I am speaking as a long time resident of Idaho Falls, a current candidate for Sheriff of Bonneville County who has a great concern for the welfare of the citizens of Idaho Falls. A portion of my law enforcement career has been as a contract investigator conducting background & special investigations at the INEL site and have a familiarity with all facilities at the site and many of the people employed there. I have been tremendously impressed with the concern for safety I have witnessed. The INEL community is composed of outstanding persons who are obviously dedicated to scientific advancement but who have not lost sight of neighbors & their welfare. I also can say the INEL site has one of the finest quality groups in any national program.

Name: Stephen White

Address: 454 10th ST (Street Address) Idaho Falls Id 83404 (City / State / Zip Code)

Please hand this form in or mail to:
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Document 50

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/20/92

A 13.1 I support SNTP siting at the INEL. The INEL has a long and distinguished history of successful reactor testing. This expertise is of utmost importance in the prevention and mitigation of adverse impacts. The EIS should address the relative experience and expertise of the candidate sites.

Name: Kenneth D. B[illegible]

Address: [illegible] Ln. (Street Address) Idaho Falls, ID 83404 (City / State / Zip Code)

Please hand this form in or mail to:
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Attn: Capt Scott Hartford
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Document 51

OFFICE OF THE STATE AUDITOR
STATE CAPITOL
BOISE 83720-0001

J D WILLIAMS
STATE AUDITOR

(208) 334-3100
FAX 334-2671

TESTIMONY

OF

HONORABLE J. D. WILLIAMS
STATE AUDITOR, STATE OF IDAHO

ON

DEPARTMENT OF DEFENSE
SPACE NUCLEAR THERMAL PROPULSION PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT

SEPTEMBER 17, 1992
IDAHO FALLS, IDAHO

MISSION: TO ENSURE THAT STATE GOVERNMENT IS ACCOUNTABLE TO EVERY IDAHO CITIZEN

Document 51

My name is J.D. Williams, and I am the elected state auditor of Idaho. I am here tonight to speak in support of siting the Space Nuclear Thermal Propulsion Project at the Idaho National Engineering Laboratory. I feel such a project would represent what I perceive to be a necessary evolution in the mission of the INEL in light of the new priorities dictated by a changing geopolitical landscape.

INEL's record of achievement in nuclear reactor research and development over the past 40 years is well documented. Its contribution to our nation's defense goals in a time of great uncertainty and fear, when the planet's two superpowers stared at one another over the nuclear abyss, has earned it the gratitude of all Americans.

But now, thankfully, the temper of the times has changed. The mission of INEL is free to change as well. And the Space Nuclear Thermal Propulsion Project is one example of the new direction that the INEL should take to harness the creative energies of the men and women of the Site who have served our nation so well, and who have so much more to give.

The successes of America's space program during the past four decades serve notice on the world of what we can accomplish when we set our goals and devote the resources to achieve them. But for all we have accomplished in space, it is not outside the realm of reality to look at our achievements to date as a prelude to a fantastic future. We have learned a great deal in the Mercury, Gemini, Apollo and Space Shuttle eras about the ability of humans to safely enter the dark void of space. But it is clear that if we are to move forward to the next step in our exploration of the universe, then our technology must evolve to a higher plane.

The project we discuss tonight represents one potential step A 13.1 in that evolution. As the testimony given tonight will indicate, the state of Idaho would welcome a decision by the federal government to locate the Space Nuclear Thermal Propulsion Project at INEL. I concur in this endorsement, and I would work together with our state officials and congressional delegation to convince the Department of Energy and other appropriate federal jurisdictions that INEL is the right place for this research with the right people at the right time.

This having been said, it is important to communicate within this forum that the environmental integrity of Idaho must be maintained for all of its citizens. As Idahoans, we are fortunate to live and work in one of the last, best regions of America in terms of the preservation of a superior quality of life. No new enterprise, no matter how important to the state's economy or INEL's future mission, can be issued a blank check to be drawn against our state's priceless resources, nor against the public health and safety of our citizens. I believe the Space Nuclear Thermal Propulsion Project as envisioned will not detract from these qualities of life and will have considerable political

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-2-

support in Idaho for both phases of the project. I don't see instances where roadblocks will be placed in its way, because it would be a very important part of the future mission of the INEL.

I appreciate the opportunity to address this forum tonight, and I look forward to the chance to continue this discussion.

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Congress of the United States
House of Representatives
Washington, DC 20515-1202

September 17, 1992

Lt. Colonel Gary Baumgartel
Director of Environmental Planning
AFCEE/ESE, Building 1155
Brooks Air Force Base, Texas 78235

Dear Colonel:

I appreciate the opportunity to express my strong support for the Space Nuclear Thermal Propulsion program and to endorse the siting of the Air Force ground test facility at the Idaho National Engineering Laboratory.

I wish I could join you and the many INEL supporters tonight for this important public hearing on the Draft Environmental Impact Statement. I regret that legislative business in Washington prevents me from attending. A 13.1 However, I want to make it clear that I believe the Idaho laboratory is the ideal location for this important test facility.

The INEL is a world-class facility and the people of our state are proud of it and the jobs it brings to Idaho. It has a long and distinguished history, and its 40-year record of achievement and responsible management is recognized throughout the U.S. and the world.

As a leading international center for nuclear research and development, its talented workforce, excellent facilities, unique capabilities, and good safety record offer the right environment to conduct this critical program. I believe the INEL can play a national leadership role as a major space exploration research and development center for nuclear propulsion and electric power.

In fact, the INEL has been assigned the lead laboratory role by the Department of Energy in planning the nuclear propulsion program for the national Space Exploration Initiative. Organizations supporting this research could quickly assume the technical roles associated with the Space Nuclear Thermal Propulsion program.

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Let me highlight several major reasons why I believe the Idaho laboratory is the best choice for the ground test facility.

First, as I mentioned earlier, the INEL has more than 40 years experience in nuclear reactor design, testing, and safety. It also maintains a quality staff with world-wide recognized expertise in this area. These technical skills are necessary for our country to have a successful nuclear thermal program.

Second, the INEL already has many of the facilities in place that would support testing, including the assembling building, hot cells for examining materials and handling large equipment, and a transportation system. The Contained Test Facility (formerly the Loss-of-Fluid Test, or LOFT facility, at Test Area North), is an excellent facility in which reactor testing would take place.

Third, in this difficult period of national budget constraints, the INEL offers an existing infrastructure -- equipment, buildings, roads, and people -- to support the full range of activities in the Space Nuclear Thermal Propulsion program in the most cost-effective manner. Since the Idaho laboratory already has the technical team and facilities needed to make the program successful, testing could be started sooner and cost less at Idaho than at any other proposed location.

The United States needs an affordable and efficient space technology program. Successful development of a nuclear thermal propulsion system technology would allow future consideration of the acquisition of a cost-effective rocket to support both national defense and civil space missions.

In closing, I support the continued development of the Space Nuclear Thermal Propulsion program and the construction of a ground test facility at the INEL. I have confidence that the Air Force will be able to construct and operate this facility in a safe and environmentally acceptable manner.

Once again, I appreciate the opportunity to share my comments and look forward to working with the Air Force on this important national initiative.

Sincerely,

Richard H. Stallings
Member of Congress

Document 53

Linda Milam
1375 South Woodruff Avenue
Idaho Falls, ID 83404

I am here this evening as a member of the Idaho Falls City Council. I am also proud to be the Immediate Past President of the Greater Idaho Falls Chamber of Commerce, a 6 1/2 year employee of the Idaho National Engineering Laboratory, and an Air Force Brat. Welcome to Idaho Falls - we expect that you will be back and that you will love it here.

I speak in support of the proposed Space Nuclear Thermal Propulsion project for several reasons:

1) the INEL has a long and proud history of nuclear safety testing and Idaho Falls has a long and proud history of support for the INEL;

2) unique facilities and a well-trained and experienced work force are in place to implement the program;

3) the project will demand minimal use of natural resources and have even less an impact on the environment;

4) there will be no adverse impact on Idaho Falls or the surrounding communities;

5) there will be, however, several significant impacts from this project - these impacts will be on U.S. space technology development and on the simultaneous advancement of earth-bound technologies.

Thank you for the opportunity to participate in this evening's hearing.

Document 54

David L. Humphrey
Deputy Director, Idaho Department of Health and Welfare
Coordinator, State of Idaho INEL Oversight Program

Testimony
Space Nuclear Thermal Propulsion Program
Draft Environmental Impact Statement
U.S. Air Force

September 17, 1992
Idaho Falls, Idaho

I am David Humphrey, deputy director of the Idaho Department of Health and Welfare. I also serve as the governor's coordinator for the State of Idaho INEL Oversight Program.

I am pleased to testify on behalf of Governor Andrus concerning the draft environmental impact statement regarding location of the Space Nuclear Thermal Propulsion Project at the Idaho National Engineering Laboratory. The State of Idaho supports this project, provided there is adequate mitigation of any adverse environmental or health impacts.

For more than 40 years, INEL has been the nation's premier nuclear reactor research and development testing facility. Its history of successful demonstrations -- on a variety of civilian and defense nuclear reactors -- validates selection of INEL for this project.

Idaho strongly supports research, technology development and demonstration programs at INEL as appropriate uses of this national laboratory. Projects such as this joint effort between the U.S. Department of Energy and the Department of Defense should be the primary mission at INEL -- especially in the field of reactor development.

In February 1992, the Air Force and DOE-Idaho briefed Governor Andrus on this project's general goals, costs and benefits. The briefing emphasized the project's ability to capitalize on INEL's outstanding research and development talent in nuclear reactor development.

In reviewing the draft environmental impact statement, the state has identified areas

1

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where more information or clarification are needed. These areas involve four major categories: Jobs and economic impacts of the project; the volume of wastes that we can expect to be generated; types of wastes that will be generated; and, disposal options for that waste.

First, the Air Force and DOE-Idaho have presented this project as one that will create new jobs in Idaho. On closer examination of the environmental statement, actual involvement of INEL personnel is limited.

Job opportunities at the project are identified mainly in the construction industry. Modification of existing facilities and other construction also may generate up to 100 jobs over an 18- to 24-month period.

Employment estimates when the program is operational range from 30 in the pre-operational stage to 50 or 60 when full-scale operations are under way. Actual field testing personnel requirements are estimated at 100 to 150 employees.

1 Two major phases of the project -- the component fabrication phases and post-
1.3 operational research -- are not planned for the INEL. The State encourages location of those activities at or near the INEL, giving the Idaho facility a greater role in the overall project.

1A Secondly, the final environmental statement must provide more detail on the amounts
6.2 and impact of wastes generated and attributed to the three main phases: operations, effluent cleanup or facility decommissioning and decontamination.

2 Volumes of some wastes are not described in sufficient detail to allow predictions about how the project will affect existing waste-handling capabilities.

6.3 Estimates indicate that this project will generate 1.6 million cubic feet of low level wastes over its 10-year life. DOE-Idaho estimates current operations generate 102,000 cubic feet

2

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2 cont'd of low level wastes per year.

Taken at face value, then, it appears this proposed project represents a 157 percent increase in generation of low level wastes.

However, 90 percent of that volume would come from dismantling and burying the facility at the close of the 10-year span. The largest portion is from decommissioning the effluent treatment systems, which are designed to remove fission contaminants generated as a result of some testing activities.

6.3 The final EIS should address waste-management techniques -- such as segregation, waste minimization and waste reduction. All of these could reduce the volume of low level waste requiring disposal.

Alternative facility uses in the future also should be explored as an option to decontamination and decommissioning.

3 The third topic involves how low level waste is characterized in the environmental statement. The draft EIS states that -- quote -- LLW is disposed in the subsurface disposal area -- at the Radioactive Waste Management Complex.

The document defines low level waste as containing transuranic nuclides in
6.4 concentrations up to 100 nanocuries per gram. Current standards at the Radioactive Waste Management Complex require wastes accepted for disposal to contain less than 10 nanocuries per gram.

Any low level waste at INEL -- with transuranic nuclide levels between 10 and 100 nanocuries per gram -- do not have a designated disposal facility.

The draft EIS does not differentiate between wastes eligible for disposal at the

3

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Radioactive Waste Management Complex those wastes above acceptable levels for disposal at that site.

4 The fourth topic concerns disposal options for mixed low level wastes.

There are no disposal options available for these wastes. This issue is a national concern -- not just limited to INEL.

6.5 The State encourages the departments of Energy and Defense to work with authorized states and the Environmental Protection Agency to solve the complex disposal problems associated with low level wastes.

The final EIS should not assume the WIPP site in New Mexico or some other facility will provide the answers to disposal of these wastes. The future is too uncertain.

A 13.1 I would like to reiterate the State's support for this project at the INEL. This Idaho facility is well-suited for the full range of activities associated with this proposal -- including plans for test facility component fabrication and post- field test research.

The INEL is a premier facility for post- field test research. Full consideration should be given to including *all these project activities at the INEL. Such a decision makes sense. It* would centralize all components at one outstanding site -- and greatly increase the economic and employment opportunities at INEL.

To clarify the project's impacts, the statement should accurately reflect rates of waste generation, the types of wastes and final volumes.

To minimize impacts of waste generation during this experiment, plans should be in place to emphasize waste minimization and reduction throughout the project. Decontamination -- rather than dismantling and disposal -- should be emphasized in the decommissioning phase.

Finally, the State must be assured that the volume of waste anticipated for this project

4

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clearly falls within the capacity of proposed waste repositories.

As a package, these recommendations will help ensure maximum economic benefits while minimizing environmental impacts of this important project.

5

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BOARD OF COMMISSIONERS

CL..FORD V. LONG, Chairman, District #2
CLYDE A. BURTENSHAW, District #3
EDITH M. STANGER, District #1

605 NORTH CAPITAL AVENUE
IDAHO FALLS, ID 83402
PHONE (208) 529-1350
FAX (208) 529-1353

September 17, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

As a Bonneville County Commissioner for the past 16 years, it has been my pleasure to work with and observe the INEL and many of the people that work there. Along with the 40 years experience in nuclear safety testing, the INEL has been a very good neighbor and always willing to work with the community on other projects--making the community a better place.

With the current technology available that could be utilized at the INEL, and the track record of achievement and past performance, it makes the INEL the ideal site for this project.

A 13.1 The Bonneville County Commissioners support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

BOARD OF COUNTY COMMISSIONERS

Clyde A. Burtenshaw

Clyde A. Burtenshaw, Member

CB/cp

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-1-92

A 13.1 I support the location of SNTP program at INEL.

Name Beulah B. [illegible]

Address 2930 [illegible] Ci — Street Address
Idaho Falls, Id [illegible] — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/17/92

A
13.1 I support the proposed concept for testing [illegible]

Name [illegible]

Address [illegible] [illegible]
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/17/92

A
13.1 I support the proposed concept for testing SNTP or SEI nuclear-propulsion engines at the INEL.

Name William C Reid

Address 2105 Northcrest Dr. Idaho Falls, ID 83404
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9.17.92

A
13.1 I support SNTP project at INEL The reasons for support are

- Technical staff and management have proved that the project can be conducted safely and effectively
- Bring American space technology
- No great impact on environment
- It can maintain USA leadership in many facets of life and technology

Name UPENDRA SINHA

Address 302 12th St #3 Idaho Falls ID 83404
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/17/92

The INEL has the infrastructure, effective emergency response and security, superior technical resources, excellent track record in nuclear research activities, and, importantly, regional support.

Waste generation, handling and the amount of $ spent in waste management activities are some important issues. We need to commit to minimization and maximum volume reduction. That means $$.

A
13.1 Space exploration and technologies is exciting and we want to assist in the engineering of the SNTP project - for Idaho + SEI.
INEL is important to Idaho and to the U.S.A. We want to maintain these relationships.

Name Brian Minner

Address 505 Adam Dr. Idaho Falls Id 83401
Street Address City / State / Zip Code

Please hand this form in or mail to:
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Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 61

David C. Hobson, D.D.S., M.S.
DIPLOMATE, AMERICAN BOARD OF ORTHODONTICS

Idaho Falls
Dental
Group

Sept. 10, 1992

RECEIVED SEP 1 1 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Capt. Hartford:

A 13.1 I am writing this letter in support of locating the Space Nuclear Thermal Propulsion Technology system at the INEL site in Idaho!

Although my background contains much scientific training, I am not well enough versed in nuclear physics to address questions of where the best place to locate the project would be from the physical facilities perspective. However, I would like to offer some comments on the personnel aspect of things.

I am a transplanted Californian, and have spent quite a bit of time in Las Vegas, where most people employed at the Nevada Test Site live. I have never lived in an area where the people are as friendly, conscientious, and goal-oriented as the people I have worked with in Idaho Falls. After having dealt with dozens of families of INEL employees, I am firmly of the opinion that it would be impossible to find a better group of people to have associated with an important project such as this. And given the reputation for government projects to be inefficient at best, it would seem in the best interests of both the Air Force and the tax payers to locate the project in an area where the orientation of site personnel is that of hard work, and a strong ethical orientation towards honesty, efficiency, etc.

With the abundance of cultural activities, summer and winter outdoor things to do, and a community based on strong family and social values, it would seem that Idaho would also be an easy area to recruit top people to as a place to live and work.

I would respectfully ask the United States Air Force to give every consideration to the many favorable reasons for locating the S.N.T.P.T. project to the INEL site.

Thank you for your consideration!

Sincerely yours,

Convenient • Comfortable • Caring

Grand Teton Mall 2... East 17th Street Idaho Falls, Idaho 83404 (208) 523 8383

Document 62

GREATER IDAHO FALLS CHAMBER OF COMMERCE

PUBLIC HEARINGS - SEPTEMBER 17, 1992
SPACE NUCLEAR THERMAL PROPULSION PROGRAM
DRAFT ENVIRONMENTAL IMPACT STATEMENT
IDAHO FALLS, ID

A 13.1 My name is Ira Koplow. I am the Executive Director of the Greater Idaho Falls Chamber of Commerce. On behalf of the Greater Idaho Falls Chamber of Commerce, I am here to testify in support of the Space Nuclear Thermal Propulsion Program locating at the Idaho National Engineering Laboratory. We would like you to know there is broad public, business and civic support for this program.

We want to express the confidence we have in the people that work at the INEL. We recognize the importance of continued leadership in space exploration from the United States. We strongly believe that the U. S. Air Force will conclude technically that the INEL is the best location because of the people and the facilities, that it is the safest location and that the community supports the program.

We believe INEL has the experienced staff to safely conduct the testing, along with the contained facilities in which to conduct the testing and other support facilities necessary to support all of this activity.

"Your Partners In Progress"

(208) 523-1010 • FAX (208) 523-2255 • 505 Lindsay Blvd. • P.O. Box 50498 • Idaho Falls, Idaho 83405-0498

Document 62

We greeted you last April in Idaho Falls with over a thousand supporters. Again, we would like to express our desire and support of this program based on the extremely strong safety record of INEL people, the experience and enthusiasm of INEL people and their ability to make this testing program happen onschedule and within budget. Our region and our state appreciate the efforts of employees working at the INEL. They are project leaders internationally in nuclear research.

Our communities near the INEL are positioned for growth and our support of additional business and population growth. Our power, water, waste disposal and educational systems are in place to support additional Air Force personnel in our community.

We extend our support and encouragement for placement of this project at the INEL. We look forward to a successful future for this project.

The Greater Idaho Falls Chamber of Commerce has a long history of supporting INEL research, INEL safety and INEL commitment to the community and to the nation. We will continue to work for and support, spin-off technology and industry from the Space Nuclear Thermal Propulsion Program.

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-17-92

I personally have high confidence in the EG&G/DOE team to handle this project in a thoroughly safe & environmentally safe manner. This is based on my 18 years in the community and as an employee at the INEL. My interface with hundreds of EG&G and DOE personnel through the years has shown dedication to safety and environmental concern. The project will be in safe hands here

Name Charles E Bruck

Address 1911 Malibu Drive Idaho Falls ID 83404
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-17-92

The program is essential to the future. As a Waste Treatment Specialist with experience in high temperature high explosive potential offgas systems there are several methods for treating theeffluent from this system.
1
2.2 INEL has the facilities to support this effort and the experienced personnel to perform well for the SNTP. The EIS should address spinoff to non-military missions

Name Arnold L. Ayers Jr.

Address 1340 Washburn, Idaho Falls Idaho 83402
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date 1/17/92

I was exposed to several lectures on the [illegible] of space exploration and methods of propulsion
A while in college. At that time I decided I
13.1 supported Space Nuclear Propulsion. As a relatively new employee of the INEL, I would prefer that you site the project in Idaho. This is for the purely selfish reason, that I wish to be involved with this project. These comments are made as a private, concerned citizen.

Name NANCY MILLIGAN

Address 1754 HOOPES IDAHO FALLS ID 83404
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/17/92

The INEL, as the lead laboratory for the DOE NP-MTR Fuel & Target Technology Development, possesses world class knowledge and capability in ceramic TRISO fuel. In addition, virtually all other national experts in TRISO ceramic fuel are under contract to INEL and can be drawn upon to support SNTP. These include General Atomics, Los Alamos National Lab, ORNL, Babcock & Wilcox, and AIFS. This extensive fuel design and performance expertise provides a significant advantage to INEL and to SNTP.

Name Finis H. Southworth

Address 2528 Parkview Lane Idaho Falls ID 83404
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sept. 17, 1992

A I am in favor of the SNTP Program
13.1 and believe that the INEL is the best place for conducting this program. Many of the facilities necessary to conduct this program and an expert scientific and engineering staff are in place at the INEL. The INEL is uniquely qualified to conduct the SNTP Program in an environmentally sound manner. Expertise and long experience in nuclear fuel behavior and fission product release and transport will ensure safe and environmentally ~~[illegible]~~ benign operations.

Name Richard R. Hobbins

Address 2810 Holly Pl. Idaho Falls ID 83402
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-17-92

A 13.1 I strongly suggest locating the SNTPP at the INEL. My husband and I came to Idaho Falls in July 1973 as newlyweds. He planned to stay in Idaho for 2 or 3 years and then "move on" to someplace "better". He found out in the first year that there was no "better"! We have raised our 2 children here and plan to remain in Idaho into retirement. INEL offers so much and the existing facilities will enable the SNTPP to begin sooner and efficiently.

Name: Karen MacDonald

Address: 2653 So. Blvd. (Street Address) Idaho Falls, IDAHO 83404 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: [illegible]

A 13.1 I support locating the SNTP program at the INEL because

- [illegible] support
- community support
- INEL facility + expertise are superior
- lowest cost alternative
- INEL + communities welcome military [illegible]
- project would complement existing INEL space initiatives
- infrastructure at INEL is in place
- lack of special interest group opposition

Name: Richard J. [illegible]

Address: 3006 Chaparral Drive (Street Address) Idaho Falls, ID [illegible] (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/17/92

A 13.1 - I support the program.
- I think it should be located in Idaho at the INEL

Specific comment

- Population effect at INEL will be [illegible], actually increase, [illegible] loss of population due to cancellation of other program.
- The [illegible] will [illegible] and the [illegible] will [illegible] against the will of the people. [illegible]

Name: James T. [illegible]

Address: [illegible] Waterford Lane, (Street Address) Idaho Falls, ID [illegible] (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9 [illegible] 92

A 13.1 I fully endorse the Space Nuclear propulsion Project for the INEL

Name: FRANK DINGMAN

Address: 1042 YELLOWPINE (Street Address) IDAHO FALLS ID 83401 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-17-92

As an elected local official, my major [illegible] is to [illegible] and to provide services [illegible] for a good quality of life in the community. As chairman of the city planning and [illegible] committee — the [illegible] of quality planning and conservation on the [illegible] will be [illegible] by [illegible]. The community of Idaho Falls [illegible] of the INEL will be a great resource — the [illegible] well educated people and an existing infrastructure.

Name: Gary Mills (City Council member)

Address: P.O. Box 50220 Idaho Falls, Id 83405
Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-1[illegible]-92

A 13.1 I would like to see you come to Idaho Falls.

Name: [illegible]

Address: 349 Kristofer Idaho Falls, Id 83402
Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/17/92

A 13.1 I support locating the SNTP Project at the INEL. The INEL has the infrastructure to support this project and the scientific & engineering talent to make the project a success. The INEL is capable to provide a safe execution of this project.

Name: Colleen R Fry

Address: 364 E. 13th St Idaho Falls ID 83404
Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

As a small farm owner and a degreed engineer, I am interested in both the environment and the technical challenge of the SNTP. Having reviewed the Draft EIS, I do not see any technical problems associated with the SNTP and the environment.

A 13.1 I fully support the deployment of this program. I support its siting at INEL.

Name: Doyle L. Batt

Address: 9134 N. 5E. Idaho Falls, Idaho 83401
Street Address / City / State / Zip Code

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Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sept 17, 92

A
13.1 I represent the United Plant Guard Workers of America Union. We very much support the S.N.T.P.
I want to Bring to your attention that Security at the I.N.EL. Is Very much a part of every Contractor at the INEL.
Protection Technology Idaho Has Recived the Security Trophy for the Year 1991 & 1992.
We are ready to Serve the U.S. Air Force in any Capacity. thank you

Name: Tommy [illegible] Walrath

Address: 2195 Iron Wood Dr. (Street Address) Idaho Falls, Idaho 83402 (City / State / Zip Code)

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Attn: Capt Scott Hartford
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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: [illegible]

I have no specific comments on the EIS. I [illegible] have some comments regarding the SNTP. I have reviewed various aspects of the proposed project and am aware of some of the siting concerns. First I believe the INEL meets all the requirements of the project. The INEL has the technical and physical resources to assure the success of this project.

A
13.1 I am strongly in favor of siting the SNTP at the INEL and know that there is strong community support for this type of project and others like it. We appreciate your consideration.

Name: Scott A Spaulding [signature]

Address: 459 Maple Dr. (Street Address) Rexburg, Idaho 83440 (City / State / Zip Code)

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Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A
13.1 I fully support [illegible] bring the SNTP to INEL.

Name: [illegible]

Address: [illegible] (Street Address) Idaho Falls ID [illegible] (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-17-92

A
13.1 I support the SNTP Project. It is something our country should have pursued aggressively before. INEL would be the better of the two proposed sites.

Name: Chris Major

Address: P.O. Box 50153 (Street Address) Idaho Falls ID 83405 (City / State / Zip Code)

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Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A
13.3 Program seems reasonable. No objections on my part.

Go for it

Name John P Bynum

Address 1792 Shasta St Idaho Falls ID 83402

Street Address — City / State / Zip Code

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date 9/17/92

I am convinced this will be a safe and environmentally sound project.

The project is one of several major scientific frontiers ~~that~~ in which our country must undertake international leadership. We (US) have lost leadership in too many areas of technology.

Scientific vision is critical to improving the educational level of our country and inspiring a new spirit of adventure in the scientific world and the general populace.

A
13.1 I would prefer the project be located in I.F. since I live here but moving forward with it is the most important thing.

Name Raymond L. Downs

Address 2624 Limerick Circle Idaho Falls, ID 83404

Street Address — City / State / Zip Code

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Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-17-92

A
13.1 I ~~am~~ am in favor of this program. Wish to have it at the INEL in Idaho Falls, Id. I think its a ideal place for it.

Have a private business in Idaho Falls. Lived here all my life (67) Good city!

Name [illegible] - B.A. [illegible] Co

Address 1870 [illegible] Idaho Falls Id 83401

Street Address — City / State / Zip Code

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Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A
13.1 Having reviewed the draft EIS, I remain convinced the SNTP poses no significant public risk. Accordingly, I judge location of the program at the INEL is in the best interest of the USA, Idaho and the INEL community. I also believe this research is in the best interest of the national long term goals for space and should, therefore, be funded.

Name Gary E. Wilson

Address 2055 Balboa, Idaho Falls, ID 83404

Street Address — City / State / Zip Code

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-17-92

A 13.1 I am in support of locating the SNTP project at the INEL because

1) the draft EIS indicates that it would not adversely affect the area or population

2) in nearly all cases the data indicate that the environmental impact would be less at INEL than other sites

3) development of safe sources of energy, particularly nuclear produced forms, has been and continues to be the mission of INEL, and

4) it would appear to be more cost effective since some facilities are already in place

Name: Tony LaRosa

Address: 1745 Carmel Dr (Street Address) Idaho Falls, ID 83402 (City / State / Zip Code)

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Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A 13.1 I support the Space Nuclear Thermal Propulsion Program at the INEL.

Name: Marilyn M. Brower

Address: 1244 Austin Ave, Idaho Falls, Idaho 83404 (Street Address / City / State / Zip Code)

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A 13.1 I SUPPORT THE SNTP AT THE INEL

Jeffrey O. Brower

PROFESSIONAL ENGINEER
STATE OF IDAHO
SPECIALTY: NUCLEAR ENGINEERING

Name: JEFFREY O. BROWER

Address: 1244 AUSTIN LN (Street Address) IDAHO FALLS ID 83404 (City / State / Zip Code)

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A 13.1 As a resident of Idaho Falls who cares about the future of our community, I am in favor of the program here (locating).
I believe we have alot to offer as a community and that this program has much to offer the residents.
As I entered the hall this evening I noticed a young man explaining some displays to the adults coming to the hearing. The opportunities for our young people are profound with this type of atmosphere.

Name: Lucy Bean

Address: 2585 Fieldstream Ln. (Street Address) ID. Falls ID 83404 (City / State / Zip Code)

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Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A 13.1 I support the Space Nuclear Thermal Propulsion Program [illegible] at INEL

Name: Polly Fillmore

Address: 220 N. Fanning #35, Ida Falls, ID 83401
Street Address / City / State / Zip Code

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Attn: Capt Scott Hartford
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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/17/92

Having reviewed the findings of the draft EIS and hearing the proposal for the SNTP program, I am convinced that it is of value to the United States. Further, I believe that it poses no significant hazard to the environment or people of Idaho. Finally, of the facilities being considered for siting, I believe Idaho's Contained Test Facility clearly is the logical choice for reasons of economics and technical expertise.

A 13.1 I strongly support siting the SNTP program at the CTF located on the INEL. Thank you.

Name: James C. Marinus

Address: 2960 Disney Dr., Idaho Falls, ID 83404
Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-17-92

A 13.1 BASED ON THE TECHNICAL CAPABILITIES AND EXISTING FACILITIES AT THE INEL, I STRONGLY SUPPORT SITING THIS PROGRAM IN IDAHO. AS A TAX PAYER I BELIEVE THIS IS THE BEST USE OF OUR TAX DOLLARS.

Name: DAVID E. WILKINS

Address: 6075 MARLISA LN, IDAHO FALLS, ID 83406
Street Address / City / State / Zip Code

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Attn: Capt Scott Hartford
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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-17-92

A 13.1 I strongly support the INEL as the site for the Space Nuclear Thermal Propulsion Program. The site has the best characteristics from many perspectives but when compared to Nevada This is especially apparent in the seismic area. The costs to build and protect the environment would be far less costly in Idaho.

The INEL has the experience and capability to build the necessary facilities as well as to run them.

Name: Harold S Blackman

Address: 2754 Waterford Ct, Idaho Falls Id 83404
Street Address / City / State / Zip Code

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Attn. Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A
13.3 I am in favor of the project.

Name John LoPiccolo

Address 434 12th St Idaho Falls ID 83404
Street Address City / State / Zip Code

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September 17, 1992

COMMENTS ON THE SNTP BY JAMES P. ADAMS

The following are comments on the proposed Space Nuclear Thermal Propulsion program by James P. Adams, 2285 Richards Ave., Idaho Falls, ID 83404.

A
13.1 I support the proposed program by the U.S. Air Force to design, build, and test a nuclear reactor for space applications. This is an exciting technology with great promise for success now and dividends in the future. I completely support designing and building the reactor on the INEL reservation for several reasons:

1. There is a long history of technical achievement inherent in the work force in place at the INEL. The personnel have been involved in the design, fabrication, testing, and decommissioning of nuclear reactors for 40 years and have the capability to do the job efficiently.

2. In today's world of concern for the environment, it is desirable to have adequate protection against unforeseen problems with the reactor. Therefore, I believe it should be built within a containment building. One already exists and is available at the INEL, which would reduce the overall cost for the project.

3. There is strong community support for this type of project in southeast Idaho. We recognize that the INEL is a good neighbor and will be responsible for all its actions. A project of this type could be the beginning of more similar space-related work which would be good for the INEL and the surrounding communities. The level of education in the area is directly linked to the type of worker associated with INEL. As a father of school-age children and one who is intensely interested in my children's educational opportunities, I support the INEL and bringing this project into Idaho.

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/17/92

A
I FULLY SUPPORT THE SNTP.
I BELIEVE THAT THIS PROJECT WILL
BE MANAGED BY THE INEL TO
ENSURE QUALITY PRODUCT WITH FULL
13.1 PROTECTION OF THE ENVIRON AND PUBLIC.
THIS PROJECT SHOULD BE LOCATED AT
THE INEL, THE NATIONS "REACTOR TESTING
STATION" -

Name H. M. JONES

Address 1273 [illegible] CT. IDAHO FALLS, ID 83404
Street Address City / State / Zip Code

Please hand this form in or mail to:
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Attn: Capt Scott Hartford
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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9-17-92

THERE ARE NO ENVIRONMENTAL ISSUES
THAT I WISH TO HAVE CLARIFIED
A
REGARDING THIS PROGRAM. I TOTALLY
13.3 SUPPORT THE SPACE NUCLEAR THERMAL
PROPULSION PROGRAM

Name LYLE DELVON

Address 2278 S [illegible] IDAHO FALLS, ID 83404
Street Address City / State / Zip Code

Please hand this form in or mail to:
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Written Comment Sheet

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Date: 9-17-92

I work at the INEL and believe it is capable of doing this work for the Air Force.

Name: Kris Stanger

Address: 3530 Sun Circle (Street Address) Idaho Falls, ID 83406 (City / State / Zip Code)

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Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

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Date: 9/

A 13.1 Thanks for the opportunity to make a statement [illegible] SNTP [illegible] resident of Idaho Falls [illegible] I [illegible] program & its location at INEL. I support this program [illegible] for the following reasons:

1st - I am convinced of the need for continued research in all technologies to maintain the viability of this nation. No frontier [illegible] greater than [illegible] space.

2nd - It's siting at INEL. Because of INEL's track record, [illegible] the nation that the R&D and testing will not only be done safely and with high regard for the environment but on time & [illegible].

3rd - INEL is supported by a consortium of universities that have [illegible] staffs & laboratories. Among the [illegible] are U of Utah, Weber State, Utah State, Boise State, Idaho State, [illegible], Montana State, U of Idaho, Washington State, Eastern Washington [illegible] universities. There are also a number of quality technical [illegible].

4th - There is an enviable record of space, nuclear & environmental [illegible] that have been successfully completed. These successes include [illegible] endeavors such as Hercules & Trident; [illegible] initiatives [illegible] States space [illegible], Idaho State [illegible] in nuclear [illegible], and collaborative efforts by a consortium of universities such as [illegible]; INEL's successes in [illegible] nuclear reactor development, safety research & safety programs, and [illegible].

Name: Dick Kenney

Address: 176 S Woodruff Ave (Street Address) Idaho Falls ID 83401 (City / State / Zip Code)

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AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 98

September 17, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 88235-5000

Dear Captain Hartford:

Thank you for this opportunity to provide input on the Space Nuclear Thermal Propulsion technology development program.

A 13.1 I am a member of the Idaho Falls Chamber of Commerce INEL Committee and a former State Senator. I support locating the testing facilities at the INEL.

There have been many firsts accomplished by workers at INEL and the Space Nuclear Thermal Propulsion Program would fit nicely by establishing the INEL as the leading site for testing new and advanced space nuclear propulsion technologies.

I have read through the environmental issues and I do not find anything that alarms me as it appears to me you have covered even worse case scenarios.

Another vital issue, I feel, is the possibility for spinoff technology. In this day and age when everyone seems to be worried about American competitiveness and jobs, there is a possibility here of benefit to the private sector in nonspace-related areas.

Thank you for this opportunity to submit these comments.

Sincerely,

Ann Rydalch

Ann Rydalch
3824 E. 17th St.
Idaho Falls, ID 83406

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LARRY E. CRAIG

United States Senate

WASHINGTON, DC 20510-1203

STATEMENT OF SENATOR LARRY E. CRAIG
Space Nuclear Thermal Propulsion Program
September 17, 1992

It is a pleasure to testify today in support of the Space Nuclear Thermal Propulsion program. I believe strongly that this program is absolutely crucial if the United States is to retain our leadership in space research and travel. Nuclear thermal propulsion systems are where the future of space travel lies, and this nation must lead the world in developing the technology.

A 13.1 **I believe this would be an ideal program to be located at the Idaho National Engineering Laboratory. The Space Nuclear Thermal Propulsion program would fit well with the facilities and the scientific expertise that exists at INEL.**

From the standpoint of national interest the program makes sense. From the standpoint of the benefits that would be recognized in Idaho the program also makes sense.

If this nation is to move forward in the area of space exploration we

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must improve our technology. This program offers that opportunity.

The direct benefits are numerous: crew safety and efficiency, lower costs per pound of payload, faster completion of missions--to name only a few.

The indirect benefits are even more numerous: advances in science and engineering, knowledge of earth and the solar system and beyond, maintaining the United States leadership in space technology, the development of spinoff technologies, advances in education--all of these benefits will serve this nation well into the next century.

I give my support to this project and believe that the Idaho National Laboratory is the appropriate site to develop the technology and its application. This program will allow the development of engineering and scientific skills that will assure the INEL is the Idaho National Engineering-in-Space Laboratory of the twenty first century.

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EITC

Eastern Idaho Technical College

September 15, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

RE: Space Nuclear Thermal Propulsion Technology

Dear Captain Hartford:

A 13.1 Eastern Idaho Technical College encourages your support to locate the Space Nuclear Program at the Idaho National Engineering Laboratory. The INEL was established in 1949 to demonstrate the safe use of nuclear energy and since that time, a wide variety of both nuclear and non-nuclear research and development programs have been conducted at the INEL. The majority of these projects have resulted in tremendous benefits to the entire nation.

As the Director of Eastern Idaho Technical College, I pledge the college's willingness to work with the INEL in developing the necessary technician-level training programs needed to support the Space Nuclear Program. Since 1949, we have worked very closely with the INEL and have created many one-of-a-kind, many only-one-in-the-state/region highly sophisticated training programs for the INEL, such as: Radiation Safety Technician, Chemistry Laboratory Technology, Quality Assurance/Nondestructive Testing, Hazardous Materials Technician, and Nuclear Security Training.

In addition to training highly skilled technician level employees for the INEL, EITC provides all Radiation/Respirator Worker training for construction workers employed at the INEL. Last year, EITC trained over 500 construction workers employed by small contractors, to do work at the INEL.

For residents who need additional assistance such as basic skills remediation, high school equivalency, and training in mathematics and general sciences, EITC also plays an important role. EITC offers a Regional Adult Learning Center staffed by professionals to expand and enhance the academic skills of adults located throughout southeastern Idaho. Without such a program, many of the technician-level positions which require highly specialized training would go unfilled or filled by residents from outside the area.

1600 Hill Road · 1600 S. 2500 E. · Idaho Falls, Idaho 83404-5788 · [illegible]

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EITC

In my position, I see the great impact the INEL plays in this community. The fantastic lifestyle enjoyed by residents of Idaho Falls, Bonneville County and the surrounding region is due in large part to the INEL. This relatively small community provides its residents with access to an excellent elementary and secondary education system and a rapidly growing system of higher education, - provided by two universities and Eastern Idaho Technical College.

A primary recommendation of a local Economic Diversification Group which was recently established in the City of Idaho Falls, is to not only gain a greater understanding of technology transfer, but how to assist existing businesses and industries in expanding it's economic base. I view the Space Nuclear Program as a prime example of economic diversification. The 100 construction workers and 40 permanent positions required to staff the Space Nuclear Program will be an excellent start towards economic development and diversification in this region.

Each year, we train hundreds of local citizens for potential employment at the INEL. As the result of our training, students secure good jobs/careers at the INEL and we see dramatic changes in their lifestyles/incomes. I believe that the Nuclear Space Program will go a long way in positively changing many more lives in the future. Again, I support the Space Nuclear Program and encourage your support to locate this technology at the INEL.

Sincerely,

Grace Sample, PH.D.
Director

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 1-15-92

INEL has the space + the infrastructure required to do all development, testing, etc. completely INSIDE as we have the containment [illegible] from the completed LOFT program. This provides [illegible] for [illegible] safety [illegible].

We have the people, the computers, the [illegible] and [illegible] required to handle the program. INEL has the best safety record of any of the DOE sites and has been the key site in the development of reactors for power production and in the Naval Reactor program.

Of interest to Utah residents, they are NOT [illegible] [illegible].

Name: C.E. White Jr.

Address: P.O. Box 50616 (Street Address) Idaho Falls, ID [illegible] (City / State / Zip Code)

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Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: [illegible]

A 13.1 [illegible] ... the University of [illegible] ... the location & execution of the SNTP [illegible]. There are 3 main reasons for the support:

1 - The availability of [illegible] training, skills & experience of personnel of the area. [illegible] supported by a dozen [illegible] along the [illegible].

2 - It would enhance the growth of the aerospace industry [illegible] number of [illegible] in the area [illegible] Space [illegible] & several [illegible]

3 - The [illegible] safety [illegible]

[illegible]

Name [illegible]

Address [illegible] Idaho Falls [illegible]
Street Address — City / State / Zip Code

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Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

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IDAHO SECTION
AMERICAN NUCLEAR SOCIETY
P.O. Box 51635 • Idaho Falls, Idaho 83405-1635

September 30, 1992

AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Dear Sir:

Thank you for this opportunity to express the views of the Idaho Section of the American Society on the Draft Environmental Impact Statement for the Space Nuclear Thermal Propulsion (SNTP) Program. The IANS is an organization of nuclear scientists and engineers in Idaho and Utah. With membership exceeding 1500, the IANS is by far the largest organization of its type in the United States. The programs and interests of the IANS completely encompass all the technical topics of the space nuclear propulsion program. Only last month we hosted a well-attended national meeting on nuclear technologies for space explorations.

Nuclear power is essential for future space missions. The amount of chemical fuel that would be required for large power sources or for propulsion over long distances beyond the moon would impose a prohibitive cost, and the long travel times would require unacceptable exposure to space radiation.

As soon as the United States began developing peaceful applications of nuclear energy, Idaho was selected for the site where most the nation's reactors would first be tested. Some 53 reactors systems have since been built and operated at the INEL, representing more experience than at any other single site in the world. Specifically relevant to the proposed project is that 31 tests on three high temperature cores were conducted here for the aircraft nuclear propulsion program. Presently the INEL is the lead laboratory for the Department of Energy's nuclear space propulsion program.

The IANS looks favorably on the conservative safety and environmental goals set by the Space Nuclear Thermal Propulsion Program. In addition to a strong base of professionals, the INEL has such facilities as the LOFT with its Contained Test Facility, and several large hot cells for disassembly and analysis, that con help meet these program goals at a

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AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000
page 2

1 6.3 reasonable cost. While we acknowledge the wisdom of using conservative estimates in the Environmental Impact Statement, we believe that recent experience and success in waste minimization at the INEL can achieve a substantial reduction in the program's actual low-level waste generation, 90% of which is projected to be decommissioning waste.

2 1.6 We urge that in evaluating the suitability of a site, the Space Nuclear Thermal Propulsion Program consider future DOE and NASA space propulsion programs, as well as possible future international cooperation in such programs. Avoiding unnecessary duplication of facilities, and eventual cost-sharing with international partners seem necessary in this time of fiscal restraint.

Finally, as the region's largest technical resource for nuclear-related issues, the Idaho Section of the American Nuclear Society would like to take this opportunity to offer our services for answering any future technical questions the community may have regarding this program.

Sincerely yours,

Dr. J. Stephen Herring
Secretary, Idaho Section
American Nuclear Society

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GENERAL PHYSICS CORPORATION

IDAHO FALLS OFFICE
1900 E. 17TH STREET, SUITE 100
IDAHO FALLS, IDAHO 83404
(208)524-3042

September 30, 1992
GP-L-414641

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

A 13.1 I am writing this letter to express my support for locating the Space Nuclear Thermal Propulsion Project at the INEL in Idaho. Unfortunately, I was unable to attend the hearings held on September 17 in Idaho Falls. Nevertheless, I feel it important to write you in support of locating the project at the INEL.

By now you have certainly heard all the technical arguments for locating the project at the INEL, including the 40 years of nuclear safety testing experience, the availability of an adequate facility, and the ability to handle and store all the radioactive waste generated during the project. However, one of the greatest assets of the INEL is the tremendous level of support from the people of Eastern Idaho.

Having only recently moved here from Maryland, I have been particularly impressed by the enthusiasm shown by the surrounding communities for the SPNT program. The large turnouts at both hearings cannot adequately demonstrate the positive support for the project felt throughout Eastern Idaho. However, as a local businessman and resident, I have seen this support on a daily basis across all walks of life.

The support of the local community must be of prime importance when selecting the location of any government project, but particularly those that involve the generation and handling of radioactive waste. The people of Eastern Idaho understand the necessities of producing these wastes and are confident in the INEL's ability to safely handle and store the waste. I believe this makes the INEL the ideal location for the SNTP project.

I urge you to support locating the SNTP at the finest research facility in the world, the INEL.

Sincerely,

GENERAL PHYSICS CORPORATION

Paul L. Weeks, Director
D.O.E. Services-Idaho

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Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/10/92

A 13.1 As a construction professional, I strongly support the siting of the SNTP program in Idaho. The use of existing buildings and infrastructure which can increase their usable life result in greater economic value for scarce resources and reduce the decontamination and decommissioning program liability by not building another facility. The ETF at INEL can have its useful life increased, infrastructure utilized and result in a significant decrease in life cycle cost for the facility. I fully support the SNTP program.

Name: James R. Allen

Address: 16 Willow Drive (Street Address) Blackfoot, Idaho [illegible] (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 106

STATE OF NEVADA

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL PROTECTION

Capitol Complex
333 W. Nye Lane
Carson City, Nevada 89710

September 30, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

RE: Draft EIS for "Space Nuclear Thermal Propulsion Program"

Dear Sir:

Enclosed is a copy of the Nevada Division of Environmental Protection's comments on the above referenced document. These comments are a duplicate of those submitted to the State Clearinghouse.

Sincerely,

Paul J. Liebendorfer, P.E.
Chief
Bureau of Federal Facilities

PJL/db

Enclosure

Document 106

CLEARINGHOUSE COMMENTS

SAI NV #93300027

TITLE: Draft EIS for "Space Nuclear Thermal Propulsion Program"

The subject document has been reviewed and the following points are considered to be inadequately addressed.

1 12.10 1) The concept of the rocket engine is to heat and burn hydrogen gas using the heat generated by a nuclear reactor having the nuclear material configured in an innovative way. The consequences of a possible uncontrolled explosion of hydrogen gas and the consequent possibly wide dispersal of highly radioactive material from the reactor core were not considered in the document.

2) There are numerous regulatory issues addressed in the document. Insufficient detail was presented in order to adequately evaluate the Projects ability to meet regulatory requirements for the following issues.

2 6.1 a) p. s-5 where the statement is made "Nonradioactive and radioactive hazardous wastes would be disposed of in existing disposal facilities. All such facilities have sufficient capacity to support the SNTP program." If high level wastes are generated disposal facilities do not exist; by definition reactor cores are high level waste.

3 12.55 b) p. 2-18 where an effluent treatment system is discussed. It is not clear if the affected public was limited to persons offsite or if appropriate consideration was given to NTS workers on site whose activities have no relationship to this proposed project. Such individuals should be classified as the public for the assessment of impacts from this project.

4 12.56 3) On page 2.25 the statement is made that "A 34.5 kilovolt overhead power distribution line approximately 2.4 miles long would be required to connect the facility to the existing 138 kV power transmission line along Mine Mountain Road. The installation of a stepdown transformer would also be required." The documented negative effects of high-voltage electric power lines and transformers on human health have not been accounted for in the Draft EIS. This is particularly surprising in view of the fact that the DOE has recently been designated the lead Federal agency for investigating the health effects of electromagnetic fields and has already sponsored two conferences devoted to this topic.

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5 5.1 4) On page 3-7 the statement is made that "Land within NTS is used exclusively for national defense and energy-related purposes by DOE and is not open to public use for any purposes, including agriculture, mining, homesteading, or recreation." This statement refers only to current land use at the NTS implying a higher level of contamination may be tolerable. It does not address the fact that alternate land utilization will be evaluated during the present Environmental Restoration activities, and that testing activities are anticipated to permanently cease in the very near future. Consideration of the other alternative land usage at the conclusion of the project should be addressed.

6 6.16 5) On page 3-15 the statement is made that "The NTS currently has a permit for generation of polychlorinated biphenyls...". This is an incorrect statement as no such permit exists at the NTS.

7 11.2 6) On page 3-45 the statement is made that "The deep aquifers, slow groundwater movement, and exceedingly slow downward movement of water in the overlying unsaturated zone serve as barriers to transport of radioactivity from underground sources (e.g. underground testing) via groundwater, preventing movement of radioactivity to off-site areas for thousands of years. The estimated average velocity of groundwater flow through the lower carbonate aquifer in central Yucca flat is 6 to 600 feet per year (DOE, 1990a)." The possible transport of unanticipated releases from the proposed facility to the groundwater and thence offsite has not been considered.

The implication of the above statement is that this point need not be considered. However, an average value estimated to within two orders of magnitude, shows an extreme lack of knowledge of existing conditions subsurface at the site. Evidence that this lack of knowledge is recognized by the DOE is the recently initiated multimillion dollar Groundwater Characterization Plan which has as its ultimate goal the characterization of the groundwater flow regime beneath the NTS.

8 6.17 7) On page 4-20 a statement is made to the effect that the life of the program will be ten years. This implies decommissioning of the facility will be then required. However, the EIS does not address the activities and related environmental impacts inherent in a decommissioning operation and the types of wastes that would result and what type of disposal facilities will be required. Thus, not all of the actual environmental impacts have been addressed in the Draft EIS.

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CITIZEN ALERT

P.O. BOX [illegible]
RENO, NV
[illegible]
(702) [illegible]
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P.O. BOX [illegible]
LAS VEGAS, NV
[illegible]
(702) [illegible]

BOARD OF DIRECTORS
[illegible]

STAFF
[illegible]
CHRIS BROWN
[illegible]
JOE SANCHEZ
Native American Program
[illegible]

Captain Scott Hartford
AFCEE/ESEP
BUILDING 1155
Brooks AFB, TX 78235

Dear Captain Hartford,

Enclosed you will find our comments on the DEIS for the Space Nuclear Thermal Propulsion Project. We are concerned about the lack of tabulation and response to public comments from the scoping period in the DEIS. We hope that the next draft of this document will reflect the public's comments, including those herein.

You will also find 177 signature cards gathered by Citizen Alert. As you can see there is widespread support for the ideas expressed on these signature cards.

Sincerely yours,

Chris Brown
Southern Nevada Director

[illegible]

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1) Need for Proposed Action

The DEIS fails to adequately discuss or justify the development and testing of the nuclear rocket program. The *document is vague: why is the technology being developed?* Who would it benefit? Despite broad statements suggesting the technology could be applied to future advanced upper stage rocket
2.1 engines and orbital transfer vehicles, and Air Force mission requirements, the DEIS fails to justify *the need for the proposed* action. The DEIS does suggest the technology could be used by the Air Force to increase global military power, reduce the cost of military operations, and decrease the logistical aspects of maintaining military forces. However, nowhere in the document are any of the ambiguous mission requirements explained or justified.

During the scoping process, the Air Force presentation at hearings, news releases and technical papers referred to the involvement of NASA as the primary user of the nuclear rocket
2 *propulsion technology. The involvement* of NASA is not developed
1.20 in the DEIS, leaving the reader only to conclude the technology will be used for military purposes (presumably SDI) and not for a trip to Mars.

2) Alternative Site Analysis

3 The DEIS does not specify a preferred alternative for
3.3 locating the ground test facility. The document simply *compares* the SMTS in Nevada with the CTF in Idaho.

In the earlier classified final EIS for the SNTP program, the SMTS site in Nevada was selected as the preferred alternative for locating the ground test facility. The classified EIS has been declassified. One of the reasons provided in the earlier document for selecting Nevada as the preferred location was the site's ability to provide a better security profile along with the notion that event related tests are common at the NTS and do not draw public attention. This ignores the large number and *relative size of the anti-testing* demonstrations at the NTS. This also fails to account for the delay of several tests during recent years due to the presence of protesters within the vicinity of ground zero at the scheduled time of a test.

4 The current DEIS makes the finding that no significant environmental impacts can be expected from construction or operation of a ground test facility at either of the proposed sites. The DEIS fails to provide the type of information needed
3.3 to support an informed siting decision.

3) Land Use Conflicts

5 Although the DEIS provides a general discussion of land use and infrastructure within a 50-mile radius of the SMTS site in Nevada, the document fails to fully assess the potential

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5 cont'd institutional conflicts arising out of future land use activities in the area. Principally, the discussion of the high-level waste repository program being conducted by DOE's Office of Civilian Radioactive Waste Management (OCWRM) at Yucca Mountain, Nevada is both shortsighted and inconclusive. Yucca Mountain is the only site in the Nation being studied for the disposal of civilian reactor fuel and high-level defense waste. Yucca Mountain is located only 19 miles from the proposed SMTS site. Repository siting guidelines stipulate that military installations and operation, including atomic energy defense activities (such as the nuclear rocket program) may not significantly affect
5.2 repository siting activities. The guidelines further require that the quality of the environment be adequately protected during repository siting.

Access to the SMTS site passes directly through Area 25. Area 25 contains the project support facilities and is the location of site investigation field studies at Yucca Mountain. Potential long-term institutional conflicts between the two programs include security and scheduling problems and the potential for increased risk of radiological exposure to OCWRM personnel and contractors.

6 Likewise, the discussion of potential conflicts between the proposed ground testing facilities at the NTS and DOE's Environmental Restoration and Waste Management (ERWM) were also not fully assessed in the document. Planned ERWM activities at NTS include the preparation of a site-wide EIS. This EIS will assess the long-term impact of environmental restoration, waste
5.1 management, and decontamination and decommissioning activities *for all programs at the site. In addition,* DOE has proposed NTS as a regional storage and disposal site for low-level and low-level mixed wastes. These plans, along with the current testing moratorium and possibility of a test ban, have already altered *historic land use activities at the site. Yet the EIS fails to* either acknowledge or address how the SNTP program would conflict with these changing mission requirements.

4) Background Radiation

Over 700 nuclear tests have been conducted at the Nevada Test Site (NTS), 100 of which were above ground atmospheric tests. Nuclear testing has left varying amounts of long-lived fission products in the soils, rock, and groundwater. In all, DOE has identified 760 separate contamination sites on the NTS. Contamination includes surface and subsurface radionuclides, buried mixed waste, organic compounds and heavy metals. Portions of the waste have been disposed of in radioactive waste management areas, landfills, leachfields, and injected into
7 underground wells. Over 10,000 acres of soil on the site are
12.59 contaminated with plutonium and uranium. Re-suspension of these materials may pose significant radiological hazards.

As mentioned above, Area 25, is adjacent to the proposed

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SMTS ground test facility and was the site of the original nuclear rocket program. Area 25 contains several contamination zones.

8 In determining the background radiation *for NTS, past* nuclear research and testing activities were not considered in
12.57 the DEIS. Background calculations presented in the document were strictly limited to the usual exposure mediums, such as cosmic radiation, terrestrial radioactive materials, x-rays, air travel, "global" nuclear weapons fallout, and exposure to radon gas --
9 based on an average national rate. The DEIS fails to consider
12.58 other available data from ongoing radiation monitoring programs at the NTS.

Historical testing activities, including the potential for *resuspension of plutonium,* and tritium left from the weapons
10 effects and rocket testing programs, could significantly increase the site's background radiation above what would be caused by
12.59 natural background causes. It is also worth noting that Citizen *Alert asked for such calculations in our scoping comments*

5) Radioactive Waste

The discussion of radioactive waste treatment, *storage, and* disposal is incomplete and misleading. The document states that approximately 1.6 million cubic feet of low-level radioactive waste would be generated over the life of the SNTP project. This radioactive waste would be created from handling of the equipment, from the Effluent Treatment System, and from decommissioning the facility.

11 The DEIS states that all low-level waste would be disposed of at the NTS Area 5 Radioactive Waste Management Site (RWMS).
6.18 The volume of low-level waste generated by the SMTS facility is *calculated* at 18 per cent of the annual amount disposed at the NTS RWMS. The DEIS does not state the basis for this calculation.
12 The ER&WM PEIS Implementation Plan states that the NTS will be
6.19 considered as a regional disposal site for low-level waste. It is *unclear if the SNTP DEIS accounts for the additional waste and if* sufficient space exists for all waste proposed for the RWMS.
13 Cumulative forecasts for waste at the NTS RWMS should include scenarios included in the PEIS. To present an accurate analysis
1.1 of the volumes of low-level waste and *the disposal option the* SNTP EIS process should be put on hold until the PEIS is completed.

14 The Effluent Treatment System will also produce waste. The DEIS fails to disclose if this will be liquid waste. Since the
6.20 NTS RWMS can not accept liquid waste, a means of treating such waste would be needed. The DEIS does not adequately deal with the question of liquid radioactive waste.

15 The DEIS also fails to account for high-level waste that
6.1 would be produced. The irradiated fuel elements will constitute,

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16 cont'd and need to be treated as, high-level waste. The DEIS has several vague statements about possible actions to be taken with regard to the out-of-service PBR cores. None of these actions

6.1 constitutes final disposal, and the EIS will not be complete without a clear statement about the final disposition of the high-level waste that will be generated.

6) Radiation Hazards

16 The DEIS calculates the worst case exposure on the basis of 1,000 seconds of reaction time, with a maximum exposure of 200 mrem. Nowhere do you make the case for why a reaction which is

12.3 out of control and leads to a meltdown or explosion would stop at 1,000 seconds. The resulting estimates of the inventory of radionuclides present and the dose delivered to a maximally exposed individual are thus inaccurate.

7) Safety Analysis

The DEIS proposes using the DOE's Safety Analysis Reporting process. The DEIS proposes a progressive system of reporting

17 along with each test series. This process will conform to DOE orders.

This approach is unacceptable. The DEIS should contain an analysis of safety procedures and structures. The document suffers two major flaws at this point - one, the promise of later safety analysis reports is not sufficient for the public

12.60 understanding of what safety steps will actually be taken and that no steps will be leapfrogged for budgetary or time concerns in the future; and two, the DOE's atrocious track record with public health and safety of its own workers is no guarantee of safety. Following DOE orders is not sufficient as a safety analysis process.

Conclusion:

A Since there is no clearly defined need or purpose for this program, under NEPA only the No Action Alternative is acceptable.

13.4 This process should be suspended until a purpose and need for the PBR and a nuclear rocket engine are defined.

If the Air Force and DOE insist that the program continue, this DEIS must be drastically re-written. In fact it should be shelved until the PEIS process on both EM&WM and Reconfiguration are completed. Both PEISs have legal priority over the SNTP EIS and the conclusions of the PEISs process will alter the final EIS on the SNTP.

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TO: Nevada Congressional Delegation, and
US Air Force

The Space Nuclear Thermal Propulsion Program (SNTP) Draft Environmental Impact Statement (DEIS) is deficient.

18 1) The Statement of Purpose is insufficient. A project that entails as much risk as a nuclear rocket engine demands a clear statement of need. The public deserves to know why

2.1 the Air Force wishes to build such an engine, and how it would be used as compared to a conventional rocket engine.

19 2) The nuclear reactors will generate high level nuclear waste. The DEIS is unclear about

6.1 the destination of this high-level nuclear waste. This program should be halted until this basic issue is resolved.

20 3) The Nevada Test Site is currently undergoing a Programmatic Environmental Impact Statement (PEIS) on both Cleanup and Modernization. Since the SNTP will generate waste and

1.1 is a new use of the Test Site, this SNTP EIS process should be halted until the PEIS's are both completed.

Name: ______________________

Address: ______________________

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Snake River Alliance

Box 1731 · Boise ID 83701 · 208/344-9161
Box 4090 · Ketchum ID 83340 · 208/726-7271
310 E. Center · Pocatello ID 83201 · 208/234-4782

October 2, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

The following comments on the draft Environmental Impact Statement (August 1992) on the Space Nuclear Thermal Propulsion Program are submitted on behalf of the 1,200 individual, family, and business members of the Snake River Alliance.

1. On May 15, 1992, the Alliance submitted comments on the SNTP to help the US Air Force define the scope of questions it must consider in an analysis of the project. Our comments addressed both specific environmental concerns and the broader policy questions all federal agencies must answer when proposing new projects. Those comments were inadequately addressed in the draft EIS.

1 2. The draft EIS does not even attempt, in any coherent fashion,

2.1 to address the question of the need for a nuclear-powered rocket, let alone ground tests for such an endeavor. The draft EIS states that "the purpose of the action is twofold. First, in order to be a technologically superior force in the future, the Air Force has a continuing mission to investigate new and promising technologies that may have potential application to (1) increase global projection of power, (2) reduce the cost of military operations, and (3) reduce logistics aspects of maintaining its military force structure. Second, there is a corresponding mission to investigate specific concepts that can meet future Air Force needs." We would posit instead that the Air Force has a continuing mission to respond to changing global conditions and economic realities. Throwing hundreds of millions of dollars on an ill-thought-out scheme does not seem to be such a response. In any case, the draft EIS does not explain the twofold purpose in enough specifics for anyone to judge whether or not the SNTP--or its test phase--would meet it.

As the staff of this project are no doubt aware, the Pentagon's independent Defense Science Board has questioned the usefulness of the SNTP and has advised against ground tests. The House Armed Services Committee has also charged that the SNTP has no military mission.

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The draft EIS also alleges that the SNTP might have potential "national benefits" in the commercial/industrial and energy arenas. In the draft EIS, these remain even murkier than its military applications.

2. In fact, though National Science and Space Administration is alleged to have a role in the SNTP, that role is not detailed in any way in the draft EIS.

3. The role of the Department of Energy, and the potential host site, is somewhat clearer. If the host site is the Idaho National Engineering Laboratory, it will be the indefinite resting place for all spent fuel from the PIPET, mini-GTA, and GTA test reactors. In addition, INEL will be the disposal site for low-level waste from the project. In fact, the project would represent an increase of 157% in the generation of LLW at INEL, or 46% of all available disposal capacity. Mixed waste and transuranic waste would also be generated, the latter in

2 decommissioning activities. The draft EIS, however, fails to

6.29 evaluate the environmental impacts of spent fuel and waste storage and disposal. Such an evaluation is necessary.

3 4. Our nation has yet to develop any policy on space nuclear

2.1 propulsion, and this project cannot proceed without such a policy.

5. The draft EIS fails to address most of the specific concerns contained in the Alliance's scoping comments. It is, in fact, one of the more obscure NEPA evaluations, though not, of course, as obscure as the heavily blacked-out classified EIS on the SNTP.

4 There is not, for instance, adequate discussion of reactor and

12.4 test containment. This is particularly important since the coolant and propellant/exhaust are one and the same.

5 6. The risk analysis in the draft EIS is inadequate. The catastrophic failure rate for space launches--after the bugs have been worked out--is a remarkably consistent 4% to 5%, and it shows no sign of declining. It is perhaps for this reason that

12.41 the Air Force plans seem to be to flight test the SNTP over Antarctica. Yet the risk analysis for the SNTP ground tests, which will occur before the bugs have been worked out, does not take such a high failure rate into account.

7. Idaho is becoming increasingly sensitive to the perils secret or classified projects pose. Any project with unproven technologies, like SNTP's, must undergo intense and continual scrutiny. But our State environmental agencies would not be able to regulate SNTP in any meaningful way, nor would the Environmental Protection Agency.

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The draft EIS states that the first decision is whether to continue with the SNTP technology. A Project Manager for the government's first nuclear rocket project answered that question when he said of the SNTP that "we're reinventing a square wheel, at tremendous cost to the taxpayer, for nothing." The Pentagon's Defense Science Board and the House Armed Services Committee both seem to agree with that assessment, as does the Snake River Alliance. As this nation's resources grow more and more strained, we must all question an $800-million square wheel.

Sincerely,

Beatrice Brailsford
Eastern Idaho Coordinator

Document 109

Clark County

Department of
Comprehensive Planning
Nuclear Waste Division
CALIFORNIA FEDERAL BUILDING
301 EAST CLARK AVENUE SUITE 570
LAS VEGAS NEVADA 89101
(702) [illegible]

September 28, 1992

Capt. Scott Hartford
AFCEE.ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Capt. Hartford

We have reviewed the Draft Environmental Impact Statement (DEIS) for the Space Nuclear Thermal Propulsion (SNTP) program. We have the following comments concerning the environmental consequences to the communities surrounding the Saddle Mountain Test Station (SMTS) located at the Nevada Test Site (NTS)

HAZARDOUS MATERIALS/WASTE MANAGEMENT

1 | 1. Although waste from this project may be classified as defense wastes, this should not circumvent local government's authority to restrict
6.13 | shipments (e.g. time of day, routes, pre-notification). We recommend that mechanisms be provided for coordination between Federal and local government agencies.

2. The amount of low-level waste proposed to be stored at NTS (1.6 million cubic feet) indicates that the program will re-enforce NTS' role as a repository and may influence the position of Congress that in fact Nevada is a "wasteland". This disposal of the materials may negatively impact local efforts relating to the Yucca Mountain Program.

2 | 3. The treatment of the low-level wastes associated with the project is being considered as an innocuous activity and is not receiving adequate detail in the plan. There has not been much discussion of the overall environmental
6.3 | consequences of the waste stream minimization or the use of bio-techniques to reduce waste volumes. Therefore, we request more details on the *minimization and volume reduction programs discussed under mitigation measures.*

COMMISSIONERS
Jay Bingham, Chairman • Karen Hayes, Vice-Chairman
Paul J. Christensen, Thalia M. Dondero, Aileen U. Pearson, Don Schlesinger, Bruce L. Woodbury
Donald L. Shalmy, County Manager

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HEALTH & SAFETY

3 | 1. One weakness in the report is the attention given to non-radiological hazards. These tests will require the use of hydrogen, cryogen, and other chemicals. These chemicals will create new problems in the areas of environment, trans-
12.49 | portation, emergency management, and toxic waste management. The study does not compare the use of these chemicals for the SNTP program with current NTS operations. It also fails to adequately discuss mitigation for these new dangers. For example, the report states that railcar transport is considered to *be the safer transportation alternative, yet it does not comment on the lack of a* rail route to NTS.

TRANSPORTATION

4 | 1. The plan is seriously lacking in a description of how the hazardous
6.14 | materials would be transported to the site, the timing of the shipments, and a discussion on the risks involved with the volume increases.

5 | 2. The discussion on the shipment of the fresh fuel to NTS also lacks specificity,
6.15 | attention to emergency response issues, and fails to address the additive risks related to these shipments on Nevada's highways.

LOCAL COMMUNITY/SOCIOECONOMIC CONSEQUENCES

6 | 1. The study assumes that all employees will be in-migrants to Nevada. Has consideration been given to the transfer of NTS workers who may lose
4.1 | their jobs as a result of the recently approved Nuclear Test Mortorium? Will crossover training be considered and, if so, is it necessary?

7 | 2. The project only has a ten-year life span. If successful, what will be
2.2 | the next step and what role will SMTS play in it? What are the possibilities for spinoff industries?

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We would appreciate your careful consideration of our concerns and comments followed by a written response. We will continue to monitor this program and reserve the right to provide further comments in the future. If you have any questions, please contact Phillip Blount of our office.

Sincerely,

DENNIS A. BECHTEL
Coordinator

DAB/PB/km

cc: Donald L. Shalmy
James L. Ley
Richard B. Holmes

L-613

Document 110

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-28-92

A 13.6 I feel it is a waste of taxp[illegible] when the money [illegible] [illegible] to help the unemployed and homeless and [illegible] people. I think the [illegible] be [illegible] [illegible] because some of the [illegible] would fall [illegible] [illegible] [illegible] [illegible] [illegible] escape, it [illegible] harmful to people's [illegible].

Name [illegible]

Address [illegible]
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 111

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-28-92

A 13.6 I feel this program is a good program but it is not the time and the place. I feel that the poor and homeless and the economy would be a better place to spend our moneys.

Since the state of Utah it is known that the radiation is already to high and we can't tolerate any more.

The national debt should be payed off before a program of this type should be undertaken.

Name [illegible]

Address 1962 E 620 N St George Ut 84770
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 112

776 Jeri Avenue
Idaho Falls, ID 83402
Sept. 14, 1992

Captain Scott Hartford:
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A 13.1 We support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

Mr. + Mrs. Lyn E. Harwood

Document 113

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-18-92

A 13.1 I attended the hearing last night, listened to the env. analysis and have concluded that I am completely favorable to testing in the IDAHO desert.

INEL has a history and culture of similar work. The current staff have nuclear reactor expertise and both a productivity and safety ethic that is not surpassed. The community and state will support the activity and not turn the program into and endless series of delays and protests and lawsuits.

The nuclear engineering skills necessary to support the Air Force are unequalled elsewhere and the community shares a considerable amount of that knowledge.

Name W J QUAPP, P.E. Nuclear Engr.

Address 860 W. Riverview Dr, Idaho Falls ID 83401
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 114

8 September 1992

AFCEE/ESEP
Attn: Captain Scott Hartford
U. S. Air Force
Building 1155
Brooks Air Force Base, Texas 78235-5000

re: Draft EIS for Space Nuclear Thermal Propulsion (SNTP) Program

Dear Captain Hartford:

1 12.6 In the Draft EIS and subsequent press releases Air Force spokesmen make the statement that residents living within 93 miles of the test site would get a larger dose of radiation from one chest X-ray than they would receive from rocket testing activities. The comparison seems to mix apples and oranges. A chest X-ray exposes a person to an acute, external source of ionizing radiation as a necessary diagnostic tool. If rocket testing takes place it will generate radionuclides that could potentially expose persons to chronic, internal exposures through ingestion, inhalation or both, for a purpose not of their choosing or need. I don't think it is accurate to equate concerns about internal deposition of alpha, beta, and gamma-emitting radionuclides and their health physics effects with those associated with an external dose of X-rays.

In the 1950's the AEC used to reassure the people of the arctic who had high body burdens of atmospheric fallout that the doses they received were "...equivalent to two chest X-rays." This pacified some people because they thought their concerns were being addressed. When a study was conducted to determine whether their were cytogenetic effects in Eskimos having the highest body burdens geneticists found ring and dicentric chromosomal aberrations that were linked to internally deposited radionuclides. There were biological effects due to the internal exposures that were not equivalent or similar to effects due to two chest X-rays.

In the public discussion about the possible effects due to radioactivity associated with proposed rocket testing it might be helpful to more clearly approach the questions being asked by not making statements that some health physicists might consider to be misleading.

Sincerely,

Thomas P. O'Farrell

Thomas P. O'Farrell
611 Avenue H
Boulder City, Nevada 89005

Document 115

Please mail this form to

AFCEE/ESEP
Attn. Capt. Scott Hartford
Building 1155
Brooks Air Force Base, TX 78235-5000

PUBLIC HEARING WRITTEN COMMENT SHEET

Space Nuclear Thermal Propulsion (SNTP) Program

I was unable to attend the public hearing on the SNTP Program held September 8, 1992, in Las Vegas, Nevada. However, my comments on the draft environmental impact statement, and on the program in general, are as follows:

Date: 9-9-92

Having reviewed the SNTP draft EIS in detail, I offer the following comments: (1) Individuals responsible for writing the EIS have done a credible job in addressing the extensive details of proposed testing.

1 3.6 (2) I am unclear as to the extent rail transportation would be used for such testing, i.e. from where to what point on which routes?? (3) What impact will the communities on truck/rail routes have in permitting/impeding material in transit in their locations? I.E. what actions/contingencies does the A.F. plan

Name: to

Address: have? (4) What form(s) of redress will

Company/Organization Represented: be available to citizens

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9-9-92

or organizations who feel they have an issue to pursue? I.E. to what extent, if any, does this enter into the SNTP planning process? (5) My unbiased opinion (unbiased because I do not consider my-

A 13.2 self pro-military or pro-government due to my experiences with both entities) is the SNTP would be best situated at the Nevada NTS location. - This is based on my "layman's" interpretation of the EIS. Thank you...

Name: T. E. Davis

Address: P.O. Box 1912 #C1-24 Las Vegas NV 89125

Company/Organization Represented:
No one but myself.

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4770 East 65th
Idaho Falls, ID 83406
September 22, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Reference: Space Nuclear Thermal Propulsion Program Draft Environmental Impact Statement, August 1992.

Dear Capt. Hartford:

1 12.4 The subject of confinement and containment is considered to need further discussion in the EIS. Containment means a pressure boundary where all nuclear materials are contained within the boundaries under the limit of its pressure; confinement is a barrier without a pressure containment. Containment acts as an additional radioactive material safety barrier between the test article and the environment. Since national policy is to reduce radioactive discharges to a level that is as low as reasonably achievable (ALARA), the use of an existing containment vessel could provide an added barrier between the nuclear test article and the environment at little cost. An example of such a facility is the Contained Test Facility at the Idaho National Engineering Laboratory. This facility was originally used to test the effects of a loss-of-fluid for terrestrial power plants. An artist concept of using the facility for nuclear rocket testing is shown in Fig. 1. The scrubber system should be located within the containment vessel; only scrubbed hydrogen should exit the facility for burning in the atmosphere. If line leaks occur in the contaminated hydrogen within the containment vessel, the hydrogen would be filtered before going to the flare stack. Such a barrier does not exist if only confinement is used. However, it might be difficult to locate all of the piping and heat exchangers within the containment vessel as currently shown in the conceptual design. A design that is less massive, such as pictured in Fig. 2, might be more economical. Even if only the part of the scrubber that contains fuel particles is retained within the containment vessel, this would significantly add to the environmental safety.

1 12.4 Therefore, although the criteria set forth in the EIS can apparently be met with confinement, containment provides an additional barrier, it better meets the ALARA principle, and it increases public acceptance.

Sincerely,

David Buden

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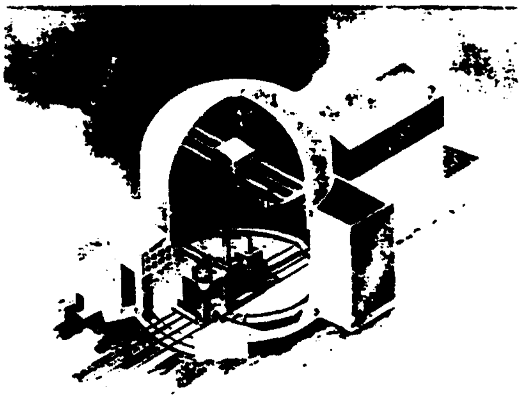

Proposed integrated engine testing facility.

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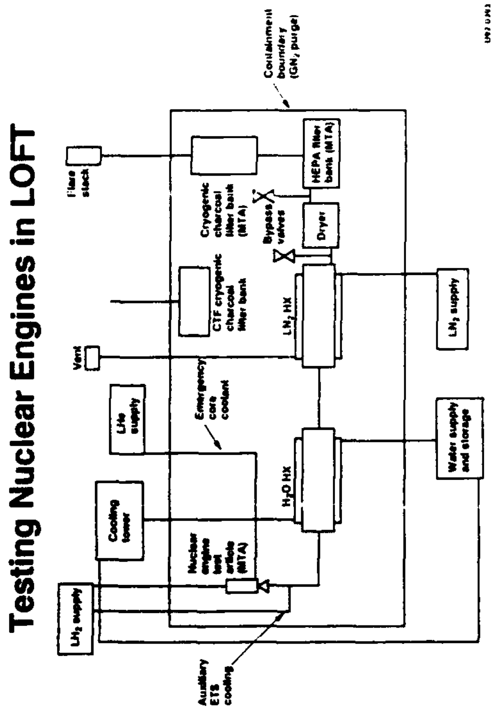

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DEPARTMENT OF HEALTH & HUMAN SERVICES

September 21, 1992

Capt Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, Texas 78235-5000

Dear Capt Hartford:

We have completed our review of the Draft Environmental Impact Statement (DEIS) for the Space Nuclear Thermal Propulsion (SNTP) program. We are responding on behalf of the U.S. Public Health Service. Technical assistance for this review was provided by the Radiation Studies Branch, Environmental Hazards and Health Effects Division, National Center for Environmental Health, Centers for Disease Control.

1 We have reviewed the DEIS for potential adverse impacts on human health. The
12.34 potential consequences of an incident are addressed. However, it is not clear
from the document if more than one reactor core will be on-site at a given
time. If this is the case, incident scenarios should include the consequences
of the fission products of multiple reactor cores being scattered by a major
2 explosion and/or fire. Since the operational scenarios (E-18) for the project
include experiments which test the limits of the core which may include
12.35 partial or full fuel element failure, some calculation of the probability of
unintentional releases from the facility should be presented. These estimates
should include the probability of and health consequences of multiple
unintended releases during this testing period.

3 While the issue of low level waste is addressed, our review did not reveal a
6.1 section in the report which addresses the ultimate disposal of the spent cores
from the project.

Thank you for the opportunity to review and comment on this draft document. Please ensure that we are included on your mailing list to receive a copy of the Final EIS, and future DEIS's which may indicate potential public health impacts and are developed under the National Environmental Policy Act (NEPA).

Sincerely yours,

Kenneth W. Holt

Kenneth W. Holt, M.S.E.H.
Special Programs Group (F29)
National Center for Environmental Health

Document 118

Environmental Defense Institute

P O Box 8812
Moscow, Idaho 83843
208-882-5071

EID

P O Box 220
Troy, Idaho 83871
208-835-6152

Comments
on
Space Nuclear Thermal
Propulsion Program
Environmental Impact Statement

Submitted on Behalf
of
Environmental Defense Institute
by
Chuck Broscious
September 21, 1992

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Document 118

I. Summary

The Environmental Defense Institute (EDI) is a non-profit public interest organization dedicated to research and public policy on environmental issues. EDI is the sponsor and coordinator of a coalition of eleven organizations called the INEL Research Bureau (IRB which was formed in 1988. The IRB coalition has focused on accessing documents through the Freedom of Information Act on the operating history of the Idaho National Engineering Laboratory (INEL). These INEL documents are used by IRB member organizations as part of their on-going analysis of the health and safety impact of INEL operations

The Space Nuclear Thermal Propulsion (SNTP) program is the most environmentally hazardous project to reach public debate in many decades. The project was forced into the public view not by the Air Force's commitment to compliance with the National Environmental Policy Act (NEPA), but because a conscientious researcher with the Federation of American Scientists exposed its existence in the secret Pentagon "black budget".

The SNTP Draft Environmental Impact Statement (DEIS) is deficient in nearly every respect. Not only is there a lack of pertinent information, but many of the assumptions used to calculate impacts are bogus. These assumptions are geared not to accurately assess impacts, but to keep the numbers within the legal limits. Therefore, little reliance or document credibility can be attributed to it.

The Draft Environmental Impact Statement has been released by the Air Force and the hearing fulfills the legal requirement to provide the public with an opportunity to comment on the document. Only four hearings have been scheduled, Los Vegas, NV, St George, UT, Salt Lake City, UT, and Idaho Falls, ID.

1 1.9 The Environmental Defense Institute is protesting the decision to only hold one hearing in Idaho. At least three additional hearings should be held in Twin Falls, Boise, and Moscow. Excluding western and northern Idaho residents from participating in this important decision is unacceptable.

2 2.1 The statement of Purpose in the DEIS is insufficient. A project that entails as much risk as a nuclear rocket engine demands a clear statement of need. the public deserves to know why the Air Force wishes to build such an engine, and how it would be used as compared to a conventional rocket engine.

3 6.1 The nuclear reactors in the SNTP program will generate high-level nuclear waste. The DEIS is unclear about the destination of this High-level nuclear waste. This program must be halted until this basic issue is resolved.

2

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4 1.1 The INEL site is currently undergoing a Programmatic Environmental Impact Statement (PEIS) on both cleanup and Modernization Since the SNAP will generate waste and is a new use of the INEL site, this SNTP EIS process should be halted until the PEIS's are both completed, or included in the PEIS process.

For Idahoans, this project is a resuscitation of the old Aircraft Nuclear Propulsion tests conducted at INEL between 1956 and 1961. According to DOE's own studies, these tests released over 781,300 curies of long-lived radiation to Idaho's air. DOE plans to reuse the same test facility and underground control room bunker located at INEL's Test Area North.

The SNTP nuclear rocket project's code name is Timberwind. Keeping the program secret would have been difficult (which the PEIS acknowledges) due to the need to evacuate large sections of the INEL site and close off three State highways during the hazardous tests.

Despite assertions in the two EIS's that Timberwind is a second stage rocket, the Air Forces' graphics released to the media have all shown the rocket as a single stage. This is a significant *discrepancy due to the radioactive* blast which will spew out of the rocket during liftoff. Even a second stage within or near the earth's atmosphere poses a monumental hazard.

Prior to the Challenger accident, NASA had stated that the probability of an accident was 1/100,000. After Challenger, NASA was *forced to revise the probability to 1/76. The actual accident* experience rate was 1/25.

The 2,000 mega watt nuclear rocket will use *highly enriched* (93%) uranium-235 fuel particles. This is the equivalent of two or three conventional nuclear electrical power reactors being run to probable meltdown in a 650 second burst. The nuclear alchemists have clearly gone off the deep end. They must realize that Idahoans will not tolerate additional radiation in their environment. Getting the military's needless Star Wars hardware into orbit around Earth simply is not worth it.

5 1.11 Another troubling issue which is not addressed is indemnification in case of an accident. This project as with all DOE projects is covered under the Price-Andersen Act which limits the governments liability in case of accidents. The domestic liability limits were recently raised from $560 million to $7 billion, and the foreign limit was set at a *whopping* $100 million.

"Idaho Governor Cecil Andrus says the [nuclear powered rocket] *project* sounds like the type of research and development the state would be interested in" according to an Associated Press story on the program. [AP,1/15/92,Los Vegas] It is hoped that once the Governor *becomes more informed* about the hazards the project poses for Idahoans, that he will reconsider his position.

3

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II. Background

The Space Nuclear Thermal Propulsion (SNTP) program is a product of the Strategic Defense Initiative Organization (SDIO) or Star Wars. In order to get the SDI hardware into orbit, SDIO initiated a nuclear propulsion development program at Sandia National Laboratory in New Mexico. The Air Forces' Phillips Laboratory in Albuquerque has been the main lab working on the reactor fuel development for the SNTP project.

Last year (1991), Steven Aftergood with the Federation of American Scientists *heard about this Pentagon black budget project and* that there was an internal classified September 19, 1991 SNTP Final Environmental Impact Statement (FEIS) prepared. He filed a Freedom of Information Act request for the document *based on the legal right* that EIS's can not be withheld. What he got was a heavily blacked out - declassified - version of the FEIS. It appears that the intent was to keep the program secret all the way through ground testing, and possibly flight testing which was slated for the antarctic. After all DOE was able to keep the Aircraft Nuclear Propulsion tests at INEL between 1956 and 1961 secret, as well as the nuclear powered cruise missile program.

The SDIO being the quiet types did not want the public to know where this program originated, much less face the public through the NEPA process. Now that the cat was out of the bag, or the genie out of the bottle, the program had to made public and heaven forbid abide by the law of the land. Therefore the program was officially transferred to the Air Force and Department of Energy (DOE) to do the dirty work of shepherding the SNTP through NEPA. The SDIO were so bashful, that all mention of their organization was blacked out in the declassified FEIS. So much for accountability.

The Air Force subsequently released its own SNTP DEIS in August 1992. It *is only one fourth* the length of the original FEIS and much less revealing. The Environmental Defense Institute gained access to a copy of the declassified FEIS through the Idaho State equivalent of *a Freedom of Information Act request* - known as an Open Records Request. The State was very reluctant to release the document but finally consented in April, and delivered in May 1992.

So there you have it. An explanation on why there is a 1991 Final Environmental Impact Statement (FEIS) and a 1992 Draft Environmental Impact Statement (*DEIS*) *for the same SNTP program*. For copies of the EIS's write:

Draft EIS	Final EIS
Capt Tom Hartford AFCEE/ESEP Building 1195 Brooks AFB,TX 78235-5000	Nat. Tech. Info. Service Springfield, Virginia 22161 Doc.No.AD/A 248408(EIS) Doc.No.AD/A 248409(Addendum)

4

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III. Comments

Both the FEIS and the DEIS fail to articulate the need to develop, test, and deploy the SNTP *beyond the scientific novelty and some* vague "potential military mission". Public evaluation of this extremely hazardous and environmentally risky program is crippled because of missing information. How can a credible assessment be made for accepting additional environmental, health, and safety impacts without a clear statement of what the offsetting benefits will be?

6 12.3 If as stated in the FEIS the Particle Bead Reactor (PBR) "may well exceed 1000 seconds of specific impulse (ISP)", [illegible] then why are the fission product calculations only done on 1000 seconds. [illegible] "The potential for releasing a larger quantity of fission products increases as the operating parameter approaches these upper limits." [illegible] The longer the reactor runs, the more

7 12.38 fission products are produced. Moreover, the DEIS calculations do not incorporate anticipated multiple Ground Test Article (GTA) tests with the same fuel assembly as planed in the FEIS [illegible] Multiple tests with the same assembly means more accumulated fission products in the fuel. "Increases in the total operational power history increase the fission product inventory in an approximately linear *fashion (i.e., a doubling of the total energy produced will approximately double the total fission product).*" [illegible] The bounding accident scenario does not contemplate an inability to SCRAM the *reactor with fuel that has been run in multiple tests. Therefore,* the fuel release fractions appear to be considerably understated.

Uncertainty exists with the fuel composition. The FEIS is

8 1.12 blacked out in the PBR fuel core composition section. [illegible] The DEIS the initially designating 93% U-235 as the fuel, leaves the door open to "other similar [fuel] particle designs that may have high performance characteristics are also possible. [illegible] Allowing such latitudes makes the EIS process meaningless. The fission release fractions will vary widely depending on the fuel used. For instance, if plutonium were used in order to gain a more instantaneous heat generation, the fission release fractions would be considerably higher. Clearly, definitive and exclusionary language on fuel type which the Departments can be held to must be in the final document.

Uncertainty also exists with the particle fuel integrity which the DEIS states that: "A typical fuel element could contain many millions of these fuel particles, each approximately 0.5 millimeters

9 12.11 in diameter." [illegible] Containment of fission products by the metal cladding around fuel has been a technological challenge throughout the nuclear reactor development history. The ability of the cladding to maintain its integrity during excursions and accidents is essential. The definition of a meltdown is when the temperatures exceed the tolerance of the cladding to contain the fuel and it literally melts. The result is loss of control of the fission reaction. What would happen if the molten fuel plugs up the gas propellent passages,

5

and the hydrogen can not escape, or operator failure does not/cannot shut the hydrogen turbo-pump off?

Quality control is extremely challenging even when dealing with a conventional fuel rod which can be x-rayed to determine if structural flaws exist. Karen Silkwood was murdered for exposing Kerr

10 McGees's falsified x-rays of defective fuel rods. The ability and/or
3.10 commitment to develop quality assurance of the integrity of millions of fuel particles is absent. The ability for such proposed minute cladding to sustain unstated "extremely high temperatures" (probably
11 around 5,000 degrees) and extremely corrosive high propellent flow
3.11 rates is iffy at best. Anticipated temperatures are blacked out in the FEIS and reactor core temperatures are not stated at all in the DEIS. This denial of crucial information is unacceptable.

12 On-going testing at Sandia National Lab of prototype fuel particles and DOE's obfuscation of the law by not getting a NESHAP permit
1.5 is unacceptable. [FEIS02 3-7] Full disclosure and environmental impact analysis of the Sandia tests is missing. This violates the programmatic requirements of NEPA.

13 Proposed testing of propellent turbo pump using a bladeless
12.8 wheel rather than a full prototype turbo-fan fails to demonstrate design capability. [FEIS02 3-9] The likelihood (cited in FEIS02 3-29) of turbo-fan disintegration and the resulting shrapnel damage to reactor control
14 systems is not fully assessed. Hydrogen is a well known problem to metallurgists because it changes the molecular bonding structure of metals causing severe embrittlement. This characteristic is also
12.39 true of most materials in hydrogen environments. *All reactor structural and control systems will face this problem* which the neither the FEIS nor the DEIS fully address. The overriding attitude is that the system only has to survive 850 to a 1000 seconds, so why worry?

15 Transporting a fully assembled reactor complete with fuel several thousand miles to the ground test site is extremely hazardous
12.40 and does not compare to other conventional fuel shipping experience. Existing shipping canisters are not designed for such unstable cargo. The FEIS only alludes to these problems without a full assessment. [FEIS02 3-13]

16 The FEIS discusses 50 sub-scale tests and says that: "These tests would include some deliberate tests to failure of the fuel and fuel elements to characterize failure mechanisms and margins." [FEIS02 3-
12.41 13] Because of the magnitude of the fuel release fractions during meltdown, the exact number of tests to failure must be specified. The additional 25 full-scale ground tests do not stipulate in bold accountable format how many of these will be run as tests to failure. Moreover, the source terms for dose to the public must reflect these tests to failure as part of "normal operations".

17 DOE's willingness to provide for protection to test personnel is
12.42 in direct contrast to lack of concern for the surrounding popula-

6

17 tions. The control bunker will be fitted with special "nuclear grade air filtration trains required to enhance control room habitability and mitigate abnormal reactor operating conditions." "The bunker would be covered with approximately two foot deep earth cover to
12.42 provide adequate protection from normal operating radiation fluxes and an improbable but hypothesized severe accident scenario involving the sub-scale test reactor." [FEIS02 3-4] What about a full scale accident scenario? How many days or weeks would the test personnel be required to remain in the bunker until it was safe to evacuate? How much of the INEL site will be evacuated for each test? What evacuation plans have been made and tested for a fifty mile rad us of the test site?

Effluent Treatment System (ETS) postulated as the emission control system as described in the FEIS and DEIS raises more ques-
18 tions than it answers. "...because the program is a developmental
12.16 program, there is some uncertainty in the actual composition of the effluent". [FEIS02 3-22] How can an emission control system be in place to mitigate unknown contaminates? Again, the temperatures, pressures, volume flow rates are either missing or blacked out. How can a reader evaluate the systems capacity to handle the job without the information? Based on what information is available the system could not possibly handle the rocket nozzle exhaust and hydrogen coolant which will probably be in the range of 150,000 lbs in compressed form (110,000 lbs used for propellent and 40,000 lbs. used for ETS coolant). In super-heated form the effluent volume the ETS must handle will be immense.

19 The FEIS acknowledges that the "effluent passes through the ETS in 5-10 seconds" which makes the use of fragile paper-thin HEPA filters as the main particulate arresters completely ludicrous. *Even* carbon filters will be questionably able to withstand the blast through the system. Additionally, no discussion as to the size of the ETS and its components making evaluation impossible. ETS size
12.16 and structural ability to withstand the anticipated pressures must be fully described. The FEIS's claim to filtration capacity of 99.9% for particulate and 99.5% for halogens (Iodides) "based upon demonstrated performance of the Nuclear Furnace as documented in the March 1973 test report" is equally ludicrous. [FEIS02 3-22] This is not a comparable or relevant test due to the difference in temperatures, volumes, and pressures.

20 There is not any discussion on how the designers plan to insure that fission materials blasted into the ETS are kept in a sub-critical geometry. The FEIS only offers that "A debris retention device would be incorporated into the ETS design to serve as a core catcher
12.16 to collect any debris that may be produced by failed fuel elements and to divert the effluent flow. This device would be designed to ensure that the material retained within it would be maintained in a sub-critical configuration." [FEIS02 3-25] With no specifics of such a "critical" issue, the reader is expected to accept the "trust us" dirge of the nuclear priests. Sufficient quantities of fuel could

7

20 cont'd accumulate anywhere in the system and create a criticality with no means of mitigating it. This risk is coupled with the extreme like-
12.16 lihood of the hydrogen coolant exploding within the confines of the ETS system.

The Heat Sink described in the FEIS but absent in the DEIS suggests that the cost of disposal of a huge amount of rock used as passive thermal absorption mass as "low-level" waste would not fly with the public. The designers knew full well that it would not be low-level waste and with increasing pressure to reduce radioactive waste generation, it is easier/cheaper to simply dump it out in the air. Since DOE does its own monitoring, who will know the difference? As for safety, the heat sink's major advantages are that: "1) it is a totally passive system and 2) it provides a large thermal mass that may help mitigate the effects of some severe core disruption accidents." [FEIS02 3-24]

21 The FEIS acknowledges that the ETS "cryogenic absorption beds and cold traps provide only temporary retention of radioactive gases, a final collection and/or disposal method must be included in an effluent processing system. Retention of these gases for several
12.75 days allows for decay of the short half-life constituents and results in a significant reduction of radioactive discharge to the environment." [FEIS02 3-26] No stipulated commitment nor specific system design exists in the document for the huge volume of radioactive gas retention needed.

What is more troubling is the legitimate concern by the designers of the potential for explosion and their desire to get the effluent out to the burn stack quickly. "Intentional burning of the remaining hydrogen effluent would prevent the accumulation and potential denotation/deflagration of the hydrogen in the vicinity of the test cell." [ibid] "Open air detonation of hydrogen could expose the facility structures to various degrees of over-pressure. All significant quantities *of hydrogen released to the atmosphere* during normal operations would be flared so that large quantities of hydrogen do not accumulate in the vicinity of the facility." [FEIS02 4-11]

22 Transporting the reactor after the test from the test cell "to an appropriate location within the test station complex to allow for decay of the radioactive fission products" poses significant hazards. The discussion in the FEIS on shielded transportation containers only
12.43 covers shipping to and from the test site and nothing between the test cell and the hot cell. The existing facility at INEL for the Aircraft Nuclear Propulsion (ANP) tests has a 1 1/2 mile rail system for moving the unshielded reactor from the test cell back into the hot cell. Exposing this highly radioactive test article to the environment as DOE did in the past ANP tests was and still is unacceptable. The huge doors in these buildings to allow the passage of
23 this rail mounted test carriage back and forth make it virtually impossible to adequately seal the buildings. Hydrogen explosion in
12.76 the test cell building would certainly further increase the hazard.

8

23 cont'd which the FEIS states that, "there is a potential disadvantage if
12.76 the integrity of the structure is such that it would not withstand the pressures associated with an accident." [FEIS02 3-1]

Continuing to see the same troubling statements on how the operators will control radiation to off-site populations decade after decade is sure evidence that DOE has not been sensitized to the suffering their operations have imposed on residents living within their shadow. The FEIS states, "Population dose would be controlled by limiting program operations to times with favorable wind speed and direction." [02 3-5] This caviler disregard for Idaho's environment over the decades of INEL operations has already resulted in the release of over 13,552,880 curies of radioactivity to Idaho air. [see attached summary of INEL releases]

24 Safety issues related to hydrogen and acknowledged in the FEIS but not in the DEIS are striking. "<u>Of the mishaps identified by NASA, only half the hydrogen releases to the atmosphere resulted in ignition.</u> Hydrogen releases to enclosures had an even lower ignition rate of 25%. The majority of the NASA mishaps resulted from operational and procedural errors." [FEIS02 4-5 emphasis added] "The main hazard in the use of hydrogen relates to combustion. Hydrogen will burn in air over a very wide range of hydrogen-air composition and is easily ignited. Deflagration-to-detonation transition of hydrogen-air mixtures is possible over a wide range of composition (4-75% hydrogen) if there are flame acceleration promoters (obstacle generated turbulence, <u>fast hot jets, etc.)</u>" [ibid emphasis added] These issues are only mentioned without full analysis on how the designers intend to mitigate these risks through specific design. How will all the air be purged out of the carbon filter beds?

12.44 "The use of liquid hydrogen introduces additional hazards. The selected condensation of air can enrich the local oxygen content increasing the possible violence *of hydrogen burns. If the system is* not purged of air, oxygen crystals can be formed in the liquid hydrogen, and liquid hydrogen-solid oxygen can form a detonable mass. There must be provision for venting in any potential fixed volume where liquid hydrogen, or even cold gaseous hydrogen, might collect. If trapped in a fixed volume, the pressure buildup as heat enters can rupture the system. At the cryogenic temperatures of liquid hydrogen the materials used must be carefully selected to ensure adequate performance at these low temperatures." [ibid.]

These hazards coupled with the large volume (176,000 kg) of hydrogen on the test site which if ignited would result in a horrendous explosion. "For the single dewar failure, this amounts to 3.55 x 10^5 [355,000] kilograms (approximately 5.4 Kilotons) TNT equivalent." [FEIS02 4-15] If 1,000 kilograms is equal to one metric ton, then the preceding statement should be 355 kilotons, not 5.4 kilotons of TNT.

Based on the accident explosion scenario formula presented in the DEIS, 1% window breakage will occur within a radius of 46.8

9

kilometers. [DEIS98-12] 46.8 kilometers is equal to 29 miles which would impact the towns of Mowe, Blue Dome, Mud Lake, Terreton, Camas and Hamer, in addition to all the residents living between these communities. [see map DEIS94-36]

25 "Plume powers necessary to specify buoyant rise are defined by the energy released from burning hydrogen and the hydrogen flow rate for normal operations. The hydrogen flow rate out the flare stack for typical operations is estimated as 134 kilograms per second (kg/s) for PIPET operations, and 536 kg/s for GTA operations The energy release from burning 1 kg of hydrogen is given as 121 megajoules per kilogram (mJ/kg). This results in a plume power of 16 2 gigawatts (GW)(1 GW equals 1 billion watts) for PIPET and 64 9 GW for GTA. A recent investigation shows that for hydrogen flow rates of 10 to 20 kg/s, one can expect a plume rise in excess of 2 kilometers." [DEIS98-6]

12.77

The power of the hydrogen to be burned at the ETS flame stack during "normal" Ground Test Article (GTA) tests will (using the DEIS formula @ E-6) shoot a plume 53.6 kilometers (33.23 miles) into the sky. This is based on a 536 kilogram/second flow rate through the ETS, and 10 kg/s creating a 1 kilometer high plume. The plume power is equal to 64.9 gigawatts (64,900 megawatts). One thousand megawatts equals one gigawatt. Most nuclear electrical power plants are 1,000 megawatts or less. In other words the ETS flare stack plume power is in the category of the power produced by 65,000 conventional nuclear power plants. At that rate, DOE will seriously impact the Yellowstone tourist trade going to see Old Faithful. The EIS is silent on the impact of concession business cropping up around INEL to show off the son of Star Wars.

26 The EIS's do not offer specific design systems to control the
12.4 reactor. Only a generalized statement is offered that there will be two redundant SCRAM systems for automatic shutdown. [FEIS92 4-12] One would expect such brevity due to the fact that the reactor rocket when finally deployed will not be expected to SCRAM. It is a one shot job.

The discussion on alternative propellent such as helium as opposed to hydrogen raises more questions than it answers. "Because helium has larger atoms than hydrogen, its use would necessitate increasing the size of the fuel pellets to allow free passage of the helium through them; otherwise a pressure drop would be created across the cold frit that would exceed its structural capacity." [FEIS92.5-1] If the structural tolerances of the reactor components are designed that close to the edge - there appears to be little margin for design errors such as the embrittlement uncertainties associated with high pressure hydrogen environments.

The FEIS discussion on using water as an alternative ETS coolant also raises more questions than it answers. If the water after being in contact with the rocket exhaust would be too contaminated for

unregulated disposal, then what will be going out the burn stack that would not be in the water No doubt the water cannot be hidden (like in the old days of injection wells), but what goes in the air is difficult to be held accountable for

"The history of engine development programs shows that component and system failures are frequently encountered. Failures impose penalties and may put successful development in doubt." [FEIS92 5-3] Indeed, the Aircraft Nuclear Propulsion (ANP) tests at INEL were such an exercise. Idahoans paid the price with nearly 800,000 curies of additional radiation released to the air. This secret program did not offer the public the opportunity of informed consent

INEL's Aircraft Nuclear Propulsion (ANP) and the Initial Engine Test (IET) Programs which were an attempt in the early 1950's to design a nuclear jet engine, released in one test (6/29/56) over 360,000 Curies of activity including significant amounts of Iodine-131 [DOE-ID-12,984-55] Between 1956 and 1961, 28 IET tests released an estimated 781,300 curies of radiation. This acknowledged release figure is understated by DOE because, "the activity reported includes the reduction due to radioactive decay that occurred during transport from the point of release to the INEL boundary." [DOE/ID-12119 @ 55]

"The ANP Reactors were direct, open cycled air cooled. This means that air was driven into the jet engine, compressed, passed through the reactor fuel element where heat energy was extracted, and then discharged through the turbine and jet engine nozzle." "Any radioactivity leaking from the fuel elements was also discharged to the air stream." [IDO-(536011-239)] Several deliberate fuel element failure tests by blocking coolant were conducted to test a full scale aircraft reactor accident. One of these tests went awry resulting in significant portions of reactor core to melt and considerable release of radiation. [Ibid.]

The US Air Force conducted the Fission Products Field Release Tests (FPFRT) between July and September 1958. "The tests were preformed to obtain information for evaluating the release of radioactivity from potential accidents involving nuclear powered aircraft using metallic reactor fuel." [DOE-ID-12119 @ 176] These open air, furnace induced hot burns of reactor fuel rods released considerable radiation to the atmosphere.

In other nuclear aircraft related tests, General Electric conducted (two) earlier tests (March 20, 1957) of open air reactor fuel rod burning tests just to see how much radiation would be released in a nuclear powered plane crash. These tests also released considerable radiation to the air. [Ibid.]

Standards developed by the federal government have historically been influenced by protecting its own operations. For instance in 1988 the DOE standard (all pathways) for occasional annual exposures was 500 mrem/yr. Today the whole body standard (40 CFR 61 as H) is

10 mrem/yr. The government has always been delinquent if not negligent in standard setting even when the preponderance of evidence supports severe health effects at existing legal levels. This is still true today. Current health research documents that the standards are not adequately protective of human health.

To demonstrate the creative genius of the EIS drafters and their commitment to making the numbers look legal, the following excerpt is cited. "Initial computer analyses were performed using inversion layers of both 1,000 m (3,280 ft) and 5,000 m (16,410 ft). The 1,000 m inversion layer results demonstrated that exceedence of applicable NESHAP's limits could occur in some severe operating scenarios. While the 5,000 m inversion layer results showed compliance with NESHAPs, a review of published meteorological information indicated that the inversion layer was seldom at that height and could not be reasonably expected to accommodate operational testing. <u>Iterations of variable inputs and data research</u> determined that an inversion layer height of 2,000 m (6,600 ft) resulted in NESHAPs compliance and existed with sufficient frequency that it would not impose unrealistic operational limitations." [FEIS92.8-5 emphasis added]

27 Additional inconsistencies in characterizing INEL's inversion challenge the credibility of the entire FEIS. "An inversion layer marks the upper boundary of the mixing depth, above which airborne materials do not diffuse freely. In most regions, the height of the inversion layer has large variations both seasonally and diurnally. At INEL, the mean height of the inversion layer above the ground surface in the morning hours ranges from about 200 to 500 meters (650- 1,640 feet) during all seasons; during afternoon hours it
12.78 ranges from about 2,000 to 3,200 meters (6,500-10,500 feet) except in winter when it remains less than 800 meters (2,600 feet) throughout the day. [FEIS93.2-40]

Based on the FEIS's own characterization of INEL's inversion layer, SNTP will be in violation of NESHAP except in the afternoon in the summer months. Both EIS's are silent any commitment to restrict tests to summer afternoons. The reader should remember that the FEIS was never intended for public access, but rather an internal secret document.

28 The FEIS contends that gross alpha and beta concentrations in the Snake River Aquifer do not exceed EPA drinking water standards. [FEIS93.2-55] This is inaccurate. INEL's Test Reactor Area (TRA)
11.6 groundwater samples taken by DOE in 1991 for beta/gamma emitting radionuclides include the following concentrations expressed in picocuries per liter (pCi/L): [Administrative Record, Summary Tables of Chemical and Radiological Analysis, Appendix C-4848405] [Analytica-ID-12782-102-4.5 to 2-632]

28 cont'd

Nuclide	Concentration	EPA 1976 Drinking Water Limit	Number of times over
Cobalt-58	601 pCi/L	1,590* pCi/L	0.38
Cobalt-60	12,200.00	100	122,000
Zinc-65	105,000	396*	265
Cesium-134	62,400	8.13*	7,675
Cesium-137	21,000,000	200	105,000
Europium-152	108,000	60	1,800
Europium-154	130,000	200	650
Europium-155	20,400	600	34
Americium-241	16,700	6.34	2,634
Manganese-54	336	733*	0.46
Chromium-51	2,540,000	6,000	423
Scandium-46	4,140	863*	4
Iron-59	2,600	844*	3
Zirconium-95	11,500	200	57
Niobium-95	12,000	2,150*	5
Ruthenium-103	3,970	1,000	3
Rhodium-106	4,980	?	?
Silver-108	14,400	723*	19
Antimony-124	150	563*	0.27
Cerium-141	6,140	1,890*	3
Hafnium-175	3,500	?	
Hafnium-181	136,000	1,170*	117
Tantalum-182	3,180	842*	3
Mercury-203	1,680	2,390*	0.70
Plutonium-239	12	15	0.80
Uranium-234	520	13.9*	37
Strontium-90	18,000	8	2,250
Tritium	3,940,000	20,000	197

11.6

* The EPA has released new draft regulations for allowable radionuclide limits in drinking water. [40CFR Part 141&142] These new proposed regulations, which are slated for prorogation in 1993, are substantially higher than the 1976 limits. They are cited here only because EPA and the State are not readily willing to offer the current standards. It should be noted that the federal government is the largest emitter of radionuclides so it is in their interest to raise the limits on their own waste sites.

The FEIS contends that no man-made radionuclides were detected in either the muscle or liver samples of sheep that had grazed on the site. [FEIS93.2-55] INEL's Test Reactor Area (TRA) pond algae registered 100 mR/hr. Ducks (usually 25 at any one time) using the pond registered the following radionuclide concentrations. [IDHA @ III-75-76]

Nuclide	Concentration	Nuclide	Concentration
Cesium-137	890 pCi/g	Cerium-141	390 pCi/g
Cobalt-60	540 "	Iodine-131	18 "
Zinc-65	1100 "		

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DOE calculated that an individual eating a duck would receive 20 mRem to the thyroid and 25 mRem whole body exposure.[Ibid] State standard limit is 4 mRem/yr. Chromium released to TRA ponds was 500 ppb The standard at the time was .05 ppb or 10,000 times over regulatory standards.[Ibid. 6(11-79)]

Continued use of the Warm Waste Pond clearly demonstrates DOE's misguided priorities and total disregard for environmental degradation. DOE is continuing to add radioactive contaminates to a site which has been identified in violation of RCRA since 1980 and slated for cleanup for over five years.[The warm waste pond activity data sheet] The continued *use of the pond insures* that water will continue leaching previous contaminants further down into the aquifer. Continued use of other percolation ponds such as the Cold Waste Pond beside the Warm Waste Pond additionally guarantees continued leaching of subsoil contaminants into the aquifer. Moreover the Environmental Protection Agency (EPA) and the State of Idaho are remiss in their respective enforcement responsibilities for not closing down the Test Reactor Area ponds.

The FEIS acknowledges that, "Because the inherent programmatic
29 uncertainty, the impacts emanating from the program also contain a
1.14 degree of uncertainty." [FEIS94 1-5] Uncertainty is, however, not addressed in the DEIS.

30 Moreover, all the planned activities discussed in the FEIS are
not assessed in the DEIS, such as flight testing. "Third, safety
analyses are performed for each aspect of the testing including
1.2 material and component testing, ground testing, and <u>flight testing</u>."
[Ibid emphasis added] This issue of not assessing the environmental impact of
flight testing in the DEIS is extremely significant. This deficiency
also suggests a whole range of undisclosed activities which are part
of the whole Strategic Defense Initiative but which have not been ac-
knowledged. Notwithstanding a single exclusionary sentence stating
30 that ground testing is not covered in the *DEIS*. This is a violation
1.2 of NEPA to exclude any interrelated/ interdependent programmatic
activities from the EIS.

31 The assessment of Beryllium released during SNTP testing does
12.45 not account for the above mentioned discrepancies in INEL's inversion
layer and therefore must be recalculated. The MACCS air dispersion
32 model used for all dose assessments for the SNTP offers no explana-
tion as to all the assumptions which were made, what features the
12.14 model was able to incorporate, what the calculation process was, why
essential wet deposition was not included, what chemistry/radioactive
decay if any was calculated, what meteorological data is required to
33 run the model, and has the model been validated/tested against known
12.20 environmental monitoring data?

34 *The FEIS contention that there is no transuranic waste in excess*
of 100 nCi/g is unfounded as is the assertion that the only high-
6.30 level waste will be spent fuel. Inconsistencies in waste character-

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34
cont'd istics are rampant in the FEIS such as: "The only waste material
which could potentially be certified as TRU would be the irradiated
6.30 fuel material should the concentration of TRU exceed 100 nCi/g."
35 [FEIS94 3-3] The anticipated LLW volume from SNTP of 1,600,000 cubic
feet [FEIS94 4-5] *to be dumped in unlined trenches at the RWMC is an*
exacerbation of an already illegal practice. The statement that,
6.8 "Therefore the environmental consequences would be insignificant"
[FEIS94 4-6] is incorrect. Arbitrary juggling of waste categories in
order to avoid the regulatory requirements for waste disposal has
been a common practice of DOE for decades.

The FEIS assessment of flaring of hydrogen from the ETS which is to "cause thermal heating of approximately 810 K (540 degree C) to a height of several hundred feet" [FEIS94 3-8] is not consistent with previously cited scenarios in the DEIS@E-6 which suggests a plume of 53.6 kilometers.

36 The total maximum committed effective dose equivalent (person-
mrem) from routine SNTP operations at INEL's QUEST is cited as 6,200
mrem over four years. [FEIS94 4-14] This dose is further clarified by a
footnote which states: "Downwind populations dose (including inges-
tion pathways and 1 day holdup and release of noble gases and halo-
gens); restricting heavily populated sectors from consideration
(winds approximately toward 22.5 degrees clockwise through 212.5
degrees). [Ibid] The dose calculation also assumes an inversion layer of
6,600 feet which as previously cited only exists on summer after-
noons. Even the OTA multiple tests (presumably less than one year)
maximum dose is 2,300 mrem. [Ibid] *These doses must be recalculated to*
12 79 reflect real site characteristics and the maximum possible popula-
tions areas must be used, and without a one day holdup because the
ETS design cannot guarantee holdup. There is no guarantee based on
DOE's sordid history that tests will be run with the wind blowing in
the right direction or that the wind may not shift as it often does,
or that DOE will only run tests on summer afternoons.

Postulated dose: "If an accident occurred during the GTA or OTA tests, the Collective CEDE was calculated to be 35,000 to 62,000 person-mrem. As discussed previously, the operation of the test facilities would be dependent on the wind direction, wind speed, and other meteorological conditions.[FEIS94 4-15] Again the footnote states: "Downwind population dose; restricting heavily populated sectors from consideration (winds approximately toward 22.5 degrees clockwise through 212.5 *degrees*." [FEIS94 4-16] *Again this is cooking the numbers*. SNTP testing "require closing of public roads within 15 km" to "include portions of State Roads 22, 28, and 33." [FEIS94 5-2]

37 The "natural dose" in the DEIS for INEL is stated as 441 mrem.
12.46 [DEIS94-27] This is a bogus number cooked up to make DOE's emissions look
benign. The background at INEL is 144 mrem. [DEIS93-55] Credible
arguments can be made that this background is not at all natural but
a direct result of *DOE* operations at the site and *from DOE's* testing
38 of nuclear weapons at NTS. Why is not the Consequence I accident
12.47

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38 using a GTA core yield with a dose of "MEI of 560 mrem at a distance
12.47 of 120 kilometers" [DEIS94-36] not shown? Again, even these doses are
considered understated as previously cited.

39 The fission product inventories cited in DEIS Appendix table E-4
12.48 should be totaled. This practice has precedence in DOE's INEL
Historical Dose Evaluation. [DOE/ID-12119 August 1991] Without the totals, no
clear or candid presentation can be claimed.

40 "Flooding of the LOFT [Loss of Fluid Test] facility [at INEL]
may be possible under conditions of maximum flows in the Big Lost
River and Birch creek combined with *failure of water control* struc-
tures on these streams." [FEIS94 5-4] This statement alone should dis-
qualify the site due to the potential for the hydrogen tank service
10.4 lines breaking as the tanks float away. Additionally, this flooding
statement challenges the use of the RWMC as a waste burial site for
SNTP waste because it is on the same gradient from the Big Lost River
flood plane as the LOFT. Infact, numerous floods at the RWMC result-
ed in waste containers floating to the surface and moving away.

The FEIS statement that "All waste management activities at INEL comply with applicable Federal, State, and local laws and regulations" [FEIS93 2-30] is inaccurate. In fact, DOE is under a court order barring additional waste shipments to INEL. This court order is the result of a State suit against DOE for non-compliant waste facilities.

41 NEPA requires all programmatic inter-related / inter-dependent
proposed actions be included in the EIS assessment. Both the FEIS
and DEIS only give brief descriptions of INEL waste management
capability; which as previously stated is grossly inaccurate. A full
6.9 and complete assessment of all new activities to be undertaken and
existing facilities to be utilized must be included in the SNTP FEIS.
This issue is especially important since a site-wide INEL EIS has not
been conducted since 1977. *Many INEL facilities have been built*
since that time without going through the EIS process.

42 The DEIS cites LLW volumes to be 1.6 million cubic feet over the
life of the project. [DEIS94-8] The DEIS is silent on volumes of TRU
6.27 wastes to be generated. This lack of information is unacceptable.

43 DOE is misrepresenting, again, the WIPP repository for TRU
wastes. WIPP may never open due to court orders blocking the opening
of the facility prior to meeting compliance criteria. Challenges to
6.6 WIPP's ability to meet new compliance criteria satisfied the court
into issuing the ban. Therefore, DOE must provide for alternate
disposal of SNTP waste should WIPP not open. Additionally, only 20%
of existing INEL TRU waste will be sent to WIPP. That means that any
additional TRU waste generated by the SNTP program does not have a
44 *final repository to go to*. DOE claims in the FEIS that INEL's Trans-
6.28 uranic Storage Area at the RWMC has additional capacity for 21
million cubic feet is unsubstantiated by permits for such additional

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44
cont'd capacity. The existing 2.3 million cubic feet of TRU waste stored at
6.28 the RWMC is in temporary tents which have already experienced failure
from snow loads in addition to RCRA violations.

The ICPP at INEL which the FEIS describes as a fully compliant waste treatment facility is currently in violation of RCRA and other laws. The percolation ponds have been in violation since 1980, yet they are still in use. DOE's waste management practice of diluting (15,000 cm/yr) 3,962,550 gallons of high-level liquid waste from the Process Equipment Waste Evaporator with (2.8 million cm/yr) 739,676,000 gallons of fresh water to dilute the radioactive concentration levels, and disposal in the percolation ponds is unconscionable. *This is "more dilution is the solution to pollution"*, policies. The ICPP's high-level liquid waste tanks are in violation of RCRA for lack of double containment, as well as structural and seismic codes.

45 INEL's RWMC Subsurface Disposal Area designated to receive SNTP
waste does not even meet nor is it permitted as a RCRA Subtitle D
let alone a Subtitle C disposal site. That means it does not even
6.8 meet standards for municipal garbage landfills. The Waste Experimen-
tal Reduction Facility (WERF) incinerator is in violation of RCRA for
inefficient and failed emission systems and the major upgrades to
WERF are in violation of NEPA for no EIS being conducted.

46 The FEIS and DEIS are silent on the fact that the INEL is a
6.10 Superfund cleanup site and that the ICPP, RWMC, and LOFT are Waste
Area Groups in that CERCLA cleanup process. Extensive contamination
has resulted *from* waste mismanagement at INEL. Cleanup at INEL is
expected to cost in excess of $ 2 billion.

47
6.17 Decontamination and decommissioning of the SNTP site facilities
and possible contaminated soil from accidents must also be fully
48 assessed and disposal site and volumes must be included in the final
6.11 public EIS documentation.

The *FEIS* assessment of the *QUEST* site at *INEL* includes the
following geologic discussion. "Individual basalt layers commonly
contain vesicles, fractures, joints, and other openings. The basalt
is expected to provide satisfactory natural foundations for test
facility structures although <u>lava tubes and other voids may require
filling prior to construction.</u>" [FEIS93 2-40 emphasis added] These statements
are cited because DOE has been denying the existence of these subsur-
49 face features. The issue is the subsurface geologies ability to
6.29 readily transit contaminants to the aquifer and off-site. Admitting
the existence of such features should disqualify INEL as a candidate
site for the SNTP and any additional radioactive waste dumping.

50 Seismic activity research is incomplete. [FEIS92 4-3] DOE continues
10.1 to understate the geologic risks at the INEL. The seismic faults
shown in the recent New Production Reactor Draft Environmental Impact
Statement (DEIS) maps [Vol 2, 4-59 and 4-60] *are not constant between maps*.
Faults shown seem to mysteriously disappear under the INEL site and

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then reappear on the other side of the site. Moreover, if the DEIS 4-59 and 4-60 seismic maps are superimposed on the 4-57 Volcanic Rift Zone map one can easily see that the faults match the rift zones

A rift, as defined by the American Geologic Institute dictionary is: "a long, narrow continental trough that is bounded by normal faults; a graben of regional extent. It marks a zone along which the entire thickness of the lithosphere has ruptured under extension." This dictionary also states that rift zones have associated volcanic activity. Therefore, a rift zone by definition contains faults, very deep seated ones, that have the potential to erupt lava.

Idaho's Governor Andrus criticized the Department of Energy's (DOE) seismic risk assessment process. "To provide the state of Idaho with a better understanding of the seismic risk assessment process, we have repeatedly requested technical observer status on the panels that are determining seismic hazard assessments. To date, the state has been denied access to the assessment process. We believe that impartial state representation would promote greater confidence in seismic findings." [illegible]

INEL had an earthquake zone 3 rating prior to a recent and arbitrary gerrymandering of the site to a zone 2. Zone 3 is the same seismic category as San Francisco. The strongest earthquake of recorded history called the Yellowstone quake occurred in 1959. This quake had its epicenter only 137 miles from INEL. The largest earthquake in Idaho (7.3) occurred in 1983 along the western flank of Borah Peak (Lost River Range) approximately 40 miles northwest of Arco. As a result, a new seismic zone of 4 was created adjacent to the INEL site.

51 A limited review of INEL's 1979 to 1981 Quarterly Seismic Reports revealed that the DOE contention in recent Environmental Impact Statements that the Snake River Plain is "aseismic" is unjustified.

The following quakes were registered on or originated on the Snake River Plain: [illegible]

10.1

Year	Number of Quakes	Magnitude Richter Scale
1979 2nd Qt.	100	(5) greater 3.0
1979 4th Qt.	68	0.1 to 1.1
1980 2nd Qt	2	1.0
1980 4th Qt.	116	0.5 to 3.3
1981 1st Qt.	91	0.1 to 2.8
1981 4th Qt.	120	0.4 to 3.5

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There are four rift zones and their related faults underlying INEL. From southwest to northeast they are.

Rift Zone	Fault
Arco	Lost River Range
Howe East Butte	Lemhi Range
Lava Ridge/ Hells Half Acre	
Circular Butte /Kettle Butte	Beaverhead Ridge

The 1988 Final Environmental Impact Statement for the Special Isotope Separator (SIS) did a seismic analysis of the INEL site "Based on the proximity to the INEL and the likelihood of generating sizable earthquakes, the faults considered to be of most significance to the proposed SIS are the range front faults located along the western flanks of the Lost River, Lemhi, and Beaverhead Ranges." "It is apparent from extensive geologic investigations as well as historic evidence that the Lost River, Lemhi, and Beaverhead Faults are capable of producing large (Magnitude 7-7.5 earthquakes in the future." [illegible]

"Detailed work on the Arco segment of the Lost River Fault indicates an average slip rate of 0.1-0.12 meters per 1000 years during the past 160,000 years. The fault has not ruptured in the past 30,000 years." "If the slip rate has been constant, the fault has a potential strain accumulation of 3 meters (9.8 feet). Since characteristic earthquakes along the Lost River Fault produced less offset than this it could be concluded that the Arco Segment is overdue and should have ruptured 10,000-20,000 years ago. [illegible]

"If an earthquake does occur, it seems most likely that it will be epicentered approximately as far away from the INEL as was the Borah Peak Earthquake, and that it will have approximately the same magnitude." "In the less likely event that an earthquake would occur on the Arco or Howe Segments during the lifetime of the SIS, ground motion would be stronger." "Predicted peak ground accelerations were calculated assuming a 7.25 magnitude earthquake on either the Arco or Howe Segments approximately 30 kilometers (18 miles) from the proposed SIS site. Utilizing attenuation curves calculated for the INEL by Tera Corp....a peak horizontal ground acceleration of 0.22g is predicted." [illegible]

If DOE's geologists had applied an equivalent earthquake magnitude of the Borah Peak (7.3) to their calculations, the ground acceleration might well approach or exceed the structural strength of the ICPP high-level waste tanks of .24g. [illegible]
"...five of them [tanks] are considered especially vulnerable. This is because their containment vaults consist of several concrete panels, grouted at the seams, that are more likely to leak or breach in a major earthquake than the six other tanks..." [illegible]

52 Complete seismic documentation and analysis must be indepen-
10.1 dently developed by the State in addition to a study that addresses

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52 cont'd the reoccurrence rates of these large earthquakes and the impact on
10.1 INEL facilities such as the high-level waste tanks.

The ICPP Calcine silos are also at risk according to a 1977 Environmental Impact Statement. "The occurrence of an earthquake of magnitude near 7.75 (Richter Scale) with an epicenter at the Arco Scrap fault, about 20 mi. west of the ICPP, would produce a maximum credible ground acceleration at the storage area of above 0.33 g (the design basis earthquake)." "The bin anchor bolts possibly might shear, and with anchor bolt failure some damage may be inflicted on bin vent piping above the bins." "No damage would be anticipated if the ground acceleration was 0.18g. [illegible] These bins must be continuously cooled due to the heat generated by the radiation which the cooling coils keep at around 480 degrees.

52 cont'd DOE's seismic analysis of existing facilities postulate an earthquake magnitude of 7 on the Richter scale generating an acceleration of 0.24g. This simply is not conservative analysis. Therefore,
10.1 an independent and competent analysis of all INEL facilities must be conducted by registered professional engineers. The implications of this position rests in the basic accountability of the individuals who sign off on DOE's documents. They must be accountable, and if so, they may consider their professional career before using non conservative assumptions.

Building 607 at INEL's Test Area North holds the core debris from the wrecked TMI reactor in pools of water yet the building "would be difficult to qualify to current standards for seismic performance, compliance with electrical code, ventilation and filtration systems, and other requirements which would be applicable to the storage of nuclear fuels." [illegible]

Recent Environmental Impact Statements and Environmental Assessments such as the INEL's Off-Site Fuels Processing Program do not
53 adequately address volcanic hazards. Craters of the Moon, which is adjacent to the INEL site, was formed 2,000 years ago - a mere blink of an eye in geologic time. In 1980 an earthquake with its epicenter at Craters of the Moon registered 1.0 on the Richter scale. [illegible]
10.5 Volcanic cones also exist on the INEL site. The Environmental Defense Institute requests a complete analysis of the potential for silicic ash-flow sheet volcanism in the INEL region. Silicic ash-flow sheets represent a sizable portion of the geologic history of the Snake River Plain and are characterized by the most violent eruption histories.

A section in the FEIS discussing a hydrogen explosion in the reactor is blacked out which is interesting due to the fact that it has nothing to do with a legitimate security issue. The footnote at the bottom reads: "If more hydrogen fuel were available for detonation, the plume would be even more dispersed than presented in this scenario and disperse the irradiated fuel over an even larger area resulting in even smaller doses." [illegible] The power of positive

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thinking - the bigger the explosion the less the radiation risk due to dispersal of the fuel.

"The operational doses are based on percent understanding of release fractions that will be further defined by the [blank] test program and are likely to be modified." [illegible] This statement
54 suggests that considerable increases in doses could be anticipated as the project progresses, and public reliance on the stated doses being
12.81 conservative is not warranted.

The release of ozone-depleting gases such as TCA (trichloroethane) and TCE (trichloroethylene) is only stated as "small amounts".
55 [illegible] This is unacceptable. The anticipated amounts of CFC's as
6.12 well as other RCRA listed hazardous substances must be stated.

"Unavoidable radiation exposure would include increased occupational exposures and exposures to the general public from normal operations." "In the unlikely event of an accident at the [blank] facility there would be a possibility that a portion of the land on the NTS or the INEL would be unavailable for use because of contamination. This would include some grazing land (at INEL)." [illegible] "In the unlikely event of an accident, additional land could be lost as a result of the contamination of soil from radioactive releases. In either case, the unavailability of land would be restricted to NTS and INEL for the most part and would preclude the use of land for testing programs and activities normally conducted there." [illegible] This is the definition of a nuclear sacrifice zone with no accountability for institutional control over this land from future users. The benefits are: "long-term improvements to national defense capability.. [illegible]

56 The DEIS cites cryogenic charcoal absorbers in the ETS but states that: "Cryogenic absorption beds and cold traps are under consideration..." [illegible] This lack of commitment and vague language challenges the credibility of the document. What reliance can the
1.13 public put on such vagueness? What documentation can DOE provide that these systems are capable under the extreme postulated pressures, volumes, temperatures; and that they are capable of one day holdup?

Despite assertions in the two EIS's that Timberwind is a second stage rocket, the Air Forces' graphics released to the media have all shown the rocket as a single stage. [illegible] This is a significant discrepancy due to the radioactive blast which will spew
57 out of the rocket during liftoff. Even a second stage within or near the earth's atmosphere poses significant hazards which have not been
1.2 addressed.

Prior to the Challenger accident, NASA had stated that the probability of an accident was 1/100,000. After Challenger, NASA was forced to revise the probability to 1/76. The actual accident experience rate was 1/25.

21

Document 118

58
6.1 The DEIS is silent on high-level waste generation and what the quantities and the final deposition of HLW waste.

Summary of Radioactive Waste Discharged to Environment or Stored at INEL

DOE's acknowledged summary of radioactive waste between 1952 and 1981 is as follows: [illegible]

Waste Type	Volume	Curies
Discharged to Environment		
1952 to 1981:		
Solid Disposed*	179,300	8,670,000
1952 to 1987		
Low-Level Liquid**	63,870	64,092
1952 to 1989		
Airborne●	112,000	13,552,880
	Total	22,286,972
Stored Waste		
1952 to 1981		
Solid Stored	47,000	74,220,000
High-Level Liquid Generated+	23,030,000	371,200,000
Calcine Stored*	1850	64,120,000
	Total	509,540,000

All Forms Discharged and Stored Total Curie

531,846,972 Curies

(does not include spent fuel in storage)

* Cubic meters (cm)(buried)
● Millions of cubic meters
** Millions of liters
\+ Liters

Document 118

IV. Other Space Nuclear Projects at INEL

The SPERT reactor test series were "planned integral core destructive tests to investigate the consequences of reactor accidents." The first November 15, 1962 SPERT-I experimental reactor "destruct" test resulted in a release of 36,000 Curies including Iodine. Coolant water was spewed out of the reactor and gross reactor damage occurred. The second SPERT reactor "destruct test" experiment on November 10, 1963 produced 24,000,000 curies of which 530 Curies were released including Iodine. The April 14, 1964, third SPERT test released 1900 Ci. to the atmosphere producing a radioactive cloud which was tracked for 2.5 mi.. What was left of the SPERT reactors and components were buried at the RWMC. [illegible]

The SNAPTRAN destructive reactor tests were part of the space nuclear power program. Since these reactors had no shielding because of the added weight limitations, tests were "designed to provide information on the radiological consequences of the accidental immersion of a SNAP 2/10A reactor in water or wet earth such as could occur during assembly, transport, or a launch abort." [illegible] The first April 1, 1964 SNAPTRAN destructive reactor test released 24,000 Curies not counting 9,500 gals. of highly contaminated water which blew out of the test tank when they intentionally allowed the reactor to blowup. The radioactive cloud was followed by an airplane for 21 miles before it dissipated. Estimated dose at INEL boundary was 10 mRem. Reactor debris was buried at RWMC. [illegible]

The SNAPTRAN second open air destructive tests in January 1966 exploded spreading reactor fuel 700 feet around the site and released 600,000 curies (Ci) including 0.1 Ci I-131 and wide spread heavy contamination of beryllium on the surrounding ground. The radioactive cloud was followed by aircraft for 19 miles before it dissipated. Estimated radiation dose at INEL boundary was 10 mRem. Again, reactor debris and 300 cubic yards of contaminated soil was buried at RWMC. [illegible]

It should be noted that two plutonium powered SNAP reactors aboard two different rockets crashed in the 1970's. The reactors and their plutonium-238 fuel were never recovered. The plutonium powered Galileo space probe is scheduled to return to Earth's atmosphere on December 8, 1992 as part of a "sling-shot" attempt to send it back out into space. Already, Galileo has had two major malfunctions which left it incommunicado for over 10 days. Should Galileo crash into Earth, it would be a world-wide disaster due to the plutonium-238 on board.

Other experiments were carried out just to see how Iodine-131 disperses in the atmosphere and surrounding ground. Twenty-nine Controlled Environmental Radioiodine Test (CERT) between May 1963 and December 1977 released over 32.72 Ci including 26 Curies of Iodine-131 to the environment. [illegible]

Document 118

Three Long Distance Diffusion Tests (LDDT) between March 1971 and August 1972 were conducted by National Oceanic and Atmospheric Administration and the Health Services Laboratory at INEL. These tests released 1000 Ci of Krypton-85 and 12.3 Ci of Iodine-131 just to see how it disperses in the atmosphere. [illegible]

Nine Experimental Cloud Exposure Study tests, appropriately named EXCES, released between May 1968 and April 1970, 987 Ci of Xe-133 and Na-24. Another air dispersion testing series called Relative Diffusion Tests (RDT) released between November 1967 to October 1969, 10.4 Ci of Iodine-131.

The US Defense Department, in 19[illegible] built the ARVFS in the center of INEL. "The facility consist of a test pit, an underground bunker, and a system of pulleys and cables. The steel-lined, open-top test pit was filled with water into which nuclear fuel elements were placed." In 1974 "four drums of radioactively contaminated NaK from EBR-1 were placed in the bunker, where they remain today. In 1980, a protective shed and crane were built above the pit and, in 1980-81, a series of explosive tests were conducted in the pit." [illegible]

The bazaar nature of these radioactive tests not to mention the cavalier disregard for the impact on populations around INEL is difficult to accept. Total acknowledged air emissions from all INEL facilities during this period (1952 and 1974) were 12,379,705 Curies, with the highest releases - 1958 through 1963. [illegible] These releases were done with full knowledge of the implicit hazards of emissions. "In 1950 the 'destructive force of the atom' and the 'harmful effects of radiation' were basically understood." [illegible] Yet, no public announcements or warnings were ever given to the public so that they could take some measure of precaution to protect themselves and their families.

Indeed INEL operations were shrouded in absolute secrecy. Only recently have public interest groups had some limited success in gaining access to historical records through the Freedom of Information Act. Today, the vast majority of the most revealing documentation is still classified or technically unavailable in contractor files. DOE's bogus claim of national security concerning forty year old radiation release documents is a testament to the erosion of our "democratic" system of government. DOE has offered no guarantees to agencies of the US Health and Human Services conducting health studies at INEL that all operating history documents will be declassified. Moreover, DOE is currently not granting security clearances to health agency researchers or their contractors.

Document 118

V. References

Andrus: Testimony given by Governor Andrus, May 16, 1991 on New Production Reactor DEIS

DEIS: Draft Environmental Impact Statement, August 1992, Space Nuclear Thermal Propulsion Program, Particle Bed Reactor Propulsion Technology Development and Validation, SNTP

DOE-ID-12219: INEL Historical Dose Evaluation, USDOE Idaho Operations Office, August 1991

ERDA-1536: Waste Management Operations, INEL Final Environmental Impact Statement, US Energy Research and Development Agency, September 1977

FEIS: Final Environmental Impact Statement, 19 September 1991, all other titles are blacked out, First sentence in the Executive Summary states: "In a program known as [blank], the [blank], as the lead agency, and the US Air Force, as the continuing lead service, purpose to develop the technology and demonstrate the feasibility of a high-temperature particle bed reactor (PBR) propulsion system to be used to power and advanced second stage nuclear rocket engine."

GAO: Nuclear Safety and Health: Radiation Events at DOE's Idaho National Engineering Laboratory, February 1991, GAO/RCED-92-64FS

IDO-10054: Radioactive Waste Management Information, 1981 Summary to date, June 1982, DOE Idaho Operations Office

IDO-10087-87: Radioactive Waste Management Information, 1987 Summary to date, June 1988, DOE Idaho Operations Office

RE-P-79: INEL Quarterly Seismic Report Series, April-June 1979 to December 1981

SIS: Special Isotope Separation Project Final Environmental Impact Statement, November 1988

Document 118

[redacted]

This is an excerpt of classified info. Block out in FEIS

Note footnote

4.6.3 [redacted]

[redacted]

'[illegible]

[redacted]

4.6 - 2

Document 118

The Nation.

March 2, 1992

Nukes for Sale

"The time has come to consider creating a global system for protection of the world community," Boris Yeltsin said on January 31, addressing President Bush and the United Nations Security Council. "It could be based on a reorientation of the U.S. Strategic Defense Initiative to make use of high technologies developed in Russia's defense complex." Yeltsin's proposal is a hot deal for the former enemies: Russia gets cash, the United States, nuclear technology—and power through the militarization of space. The losers are the planet and its peoples.

A deal to buy Russia's Topaz 2 space reactor was struck more than a year ago and announced in January 1991 at the eighth annual Symposium on Space Nuclear Power Systems in New Mexico. Nikolai Ponomarev-Stepnoi, first deputy of the Kurchatov Institute of Atomic Power in Moscow, explained at the time, "Our institution got its budget cut 50 percent and we need to look for finances from different sources." As for the cost to the United States, Richard Verga, director of key technologies for the Pentagon's Strategic Defense Initiative Organization, said that Topaz 2 would be used in a program with an overall cost of $100 million. The Topaz, a reactor that produces energy through nuclear fission as it orbits the Earth, uses a "thermionic" design—technology in which Russia outstrips the United States. It could be mass-produced here to provide power to weaponry on Star Wars battle platforms.

The Topaz 2 deal poses stiff competition to General Electric, which is developing a Star Wars nuclear reactor of its own, the SP-100, and is causing a split among U.S. policymakers. In a January 6 memo the White House Office of Management and Budget ordered the Energy Department and NASA to give preference to the Topaz 2 because "the potential availability of the Topaz 2 offers new possibilities," and it cut D.O.E.'s SP-100 budget for 1993 from $40 million to $30 million. The Pentagon also favors the Topaz, claiming it can be deployed in three years at a tenth the cost of the SP-100, which has a price tag of $1.6 billion and can't be tested until 2004. *But D.O.E., longtime friend to G.E., insists* SP-100's liquid metal heat system is "ahead of thermionics."

This past January the Russians were back with more deals—and some veiled threats of selling to Libya—at the ninth annual Symposium on Space Nuclear Power Systems. This time they were peddling their nuclear-powered rockets. Coincidentally, the Pentagon had just disclosed some of its own plans for nuclear-powered rockets. Scrubbed in 1972 after seventeen years of development as too dangerous and too costly (at $1.5 billion already spent—$4.5 billion in today's dollars), the project was covertly reopened for Star Wars in 1987 code-named Timberwind and kept in deep secrecy. Nuclear-powered rockets, with a stronger blast force than conventional ones, would theoretically be able to loft the massive lasers, particle-beam devices and other heavy Star Wars weaponry into orbit. Air Force spokesmen admitted to a cost of $800 million for the project. The designer and manufacturer of the U.S. nuclear-powered rocket engine is Babcock and Wilcox, of Three Mile Island fame.

Lost in the scramble for dollars and technology is careful consideration of what the nuclearization of space can cost the planet—in dollars and in lives. In dollars: The Star Wars budget jumped from $2.9 billion in 1991 to $4.1 billion this year. The White House is calling for a record 1993 Star Wars budget of $5.4 billion.

In danger: There has been a 15 percent failure rate in both U.S. and Soviet nuclear space hardware. The most serious U.S. accident occurred in 1964, when a plutonium-powered satellite fell toward Earth, breaking up in the atmosphere and showering plutonium over vast areas of the planet. Russian nuclear-powered satellites have also fallen to Earth. The 1978 crash of Cosmos 954 covered a broad swath of Canada with radioactive debris. Topaz or SP-100, Timberwind or Russian rocketry, they're Chernobyls in the sky.

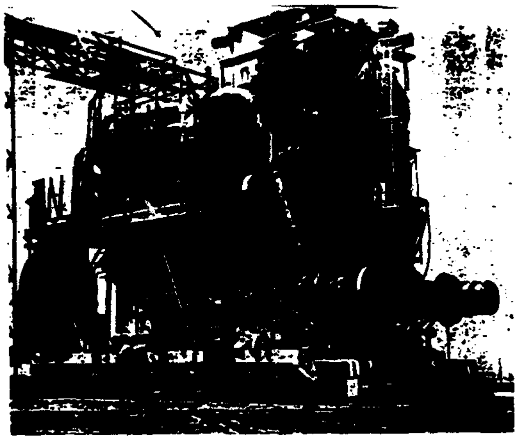
Government documents on Timberwind told of a prototype of the nuclear rocket failing on the ground. Still, the Pentagon planned a test flight, which for "safety" reasons would take place mostly over water around Antarctica, though New Zealand is on its path. A government analysis put the chances of the nuclear rocket crashing into New Zealand at 1 in 2,325. (For some perspective on these odds, recall that the chances of a Challenger-type disaster were estimated at 1 in 100,000.) The Topaz 2 has been used in only two missions, in 1987. Both ended because of a malfunction in the reactor.

This past July, insuring against accidents with U.S. nuclear space machinery, NASA and D.O.E. signed a Space Nuclear Power Agreement limiting U.S. liability in the event of a nuclear accident in space to $7.3 billion to Americans for property damage or death from radioactive contamination and $100 million, total, for citizens of all other nations. Five months earlier, the United States withdrew support for U.N. draft guidelines on the use of nuclear space devices because the Defense Department and NASA feared that Star Wars might be hindered by such a treaty. It's the nuke world order.

KARL GROSSMAN AND JUDITH LONG

Karl Grossman, a journalism professor at SUNY, Old Westbury, is the author of Cover-up: What You Are Not Supposed to Know About Nuclear Power *(Permanent Press). Judith Long has been a Nation copy editor for eleven years.*

Document 118



Plane reactor tester. This core test facility at the National Reactor Testing Station, Idaho, was used to carry out the United States first successful ground operation of an airplane jet engine on power from a nuclear reactor. At right in picture are modified jet engines which are connected by ducts to the direct-cycle reactor located in the large central tank. Air is passed through the compressor of the jet engine, then to the reactor where it is heated directly by the reactor fuel elements. The heated air then is passed through the engine turbines and out through the engine nozzles at extreme right. The ground test equipment is mounted on a dual flat car so that it can be drawn between test and maintenance areas by a shielded locomotive, shown at the extreme left.

reactor, of course, was not used for propulsion); and the accumulation of thousands of hours of irradiation testing of aircraft materials, components, and subsystems.

Nuclear Propulsion for Unmanned Vehicles

Reactors under development for use in unmanned vehicles include those to propel rocket and ramjet types of missiles (Projects ROVER and PLUTO), and to provide a source of nuclear auxiliary power (Project SNAP) for space satellites.

Document 118

WORLD'S #1 ENVIRONMENT NEWS SERVICE

E-SHEET

We Cover The Earth For You.

... FACTS. FIRST. FAST.

Monday, December 23, 1991

NUCLEAR REACTORS PROLIFERATE IN SPACE

1991 Round-Up of Events

by Karl Grossman

NEW YORK, Dec. 23 (ENS) -- [illegible]

Document 118

UNIFIED COMMAND FOR SOVIET NUKES

JAPAN CO-SPONSORS UN DRIFTNET BAN

ECUADOR FACES WATER TRIAL

Document 119

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 10/1/92

13.4 I am opposed to the Space Nuclear Thermal Propulsion Program. I believe that tax dollars would be better spent helping people + peacekeeping ventures.

2.1 I am also concerned about the stated purposes or objectives of the program. I don't believe the objectives of Nuclear Thermal Propulsion has been adequately explained. I question the spending of that much money for a program with unclear or hidden objectives.

Name: Sandy Farrell

Address: 2287 Pintura Dr. (Street Address) St George Ut 84770 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 120

United States Senate
Senator Larry E. Craig
Idaho

Jeff Schrade
Regional Assistant

(208) 883-5641
FAX 883-0136

24 September 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford

Just a reminder that INEL is the preferred site by U.S. Senator's Steve Symms, Larry Craig & Jim McClure (Ret). INEL is also preferred by Congressman Richard Stallings and Boise Mayor Dirk Kempthorne. Both of these men are running for the U.S. Senate seat now held by Sen. Symms.

Thanks

Jeff Schrade

Document 121

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/27/92

13.1 I am in support of locating the program at the INEL site in Idaho

Name: Mike Hodge

Address: 11060 Netherland (Street Address) Boise, Idaho 83709 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 122

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-24-92

Please No more Killing... Let us Live ☺

Name: K Holt

Address: 484 S. 300 E. St Geo. Ut. 84770
Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 123

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sept 17, 1992

A 13.1 I support the Space Nuclear Thermal Propulsion Program at the INEL.

Name: [illegible]

Address: 1244 [illegible] Ave, Idaho Falls, ID 83404
Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 124

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sept 17, 1992

A 13.1 This is to inform you that I support the SNTP program at the INEL. I feel that the expertise and facilities of the INEL make it the most appropriate site for this program.

Name: [illegible]

Address: 1831 [illegible], Idaho Falls, ID 83401
Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 125

ELLSWORTH BROS. INC.

Sept. 26, 1992

Captian Scott Hartford
AFC../ESEP
Building 1155
Brooks AFB, TX -78235-5000

Dear Sir:

The meeting held in Idaho Falls, Idaho at the Shilo Inn on 9-17-92 to discuss the "Space Nuclear Thermal Propulsion Program" was well presented and very interesting.

However, at the age of 84 years I must confess that much of the nuclear discussion was beyond my comprehension. Not that it wasn't done properly, but probably because I am from a earlier generation.

I have lived in Idaho Falls for 47 years, and operated a successful business for that time. The city has enjoyed a good planned growth during these years. I feel the city has much to offer the individuals and their families that this project will require.

No doubt your organization has carefully considered the excellent living conditions to be offered her in Idaho Falls, but I would like to list a few of them.

1. A well run city government.
2. A good climate both summer and winter.
3. Excellent Schools - even higher education available.
4. Low crime rate.
5. Moderate living costs.
6. Good drinking water
7. Good place to raise a family.
8. Clean Air.
9. Friendly people.
10. Good Religious facilities.
11. Recreational areas- such fishing, boating, water skiing, snow maching, snow skiing, swimming, mountain hiking, etc.
12. Vacationing - close to Yellowstone Park, Teton Nat'l Park, Sun Valley, Craters of the Moon Park.
13 ETC.

Your consideration of Idaho Falls is appreciated.

Sincerely,

Jack B. Ellsworth Sr.
1333 S. Woodruff
Idaho Falls, Idaho 83404

Document 126

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sept 23 1992

A
13.1 I support the Space Nuclear Thermal Propulsion program at the INEL.

Name Peggy Jo Cook

Address 810 E 1200 N. Shelley Id 83274
Street Address City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 127

American Heritage

288 1st St. Idaho Falls, ID 83401 • Telephone (208) [illegible]

September 23, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford,

A
13.1 I appreciate this opportunity to express my strong support for the Space Nuclear Thermal Propulsion Program and to urge the siting of the Air Force Ground Test Facility at the Idaho National Engineering Laboratory.

The INEL has often been referred to as a jewel in the Department of Energy's Crown of Laboratories. The people of Idaho are proud of its accomplishments and the jobs it brings to Idaho. Its 40 year record of achievement and history making goes unheralded. The INEL is recognized the world over for its pool of highly trained engineers and technicians in the field of nuclear energy exploration.

The community of Idaho Falls and surrounding areas have united to show support for the Space Nuclear Thermal Propulsion Program and I have confidence that the air force will be objective in its final decision and I am also confident that the decision will favor the facility at INEL.

Sincerely,

Ron Clawson
President, Greater Idaho Falls Chamber of Commerce

RC/tc

Document 128

340 E. Anderson
Idaho Falls, Idaho 83401
(208) 524-1010

September 15, 1992

Captain Scott Hartford:
AFCEE ESEP
Building 1155
Brooks AFB, Tx. 78235-5000

Dear Capt. Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at INEL.

A
13.1 We support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

Concerned Citizens and Employees of Louie's Pizza and Italian Restaurant

Document 129

September 11, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A
13.1 I support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

R. Scott Harward
1639 Irving
Idaho Falls, Idaho 83401

Document 130

EASTERN IDAHO REGIONAL MEDICAL CENTER "Quality People, Quality Care"

September 11, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, Texas 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing, and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

13.1 A | We support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

Stephen L. Wolston
Chief Executive Officer

SLW/asp

3100 Channing Way
Idaho Falls, Idaho 83404
P.O. Box 2077, 83403-2077
(208) 529-6111

An Affiliate of HealthTrust Inc. The Hospital Company

Document 131

September 11, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

13.1 A | I support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

Jones
384 Gustafson Dr
Idaho Falls, ID
83402

Document 132

DESERT RESEARCH INSTITUTE
University and Community College System of Nevada
James V. Taranik
President

P.O. Box 19040
Las Vegas, Nevada 89132-0040
(702) 895-0486
FAX (702) 895-0496

P.O. Box 60220
Reno, Nevada 89506-0220
(702) 673-7312
FAX (702) 673-7421

September 11, 1992

AFCEE/ESEP
Attn: Capt. Scott Hartford
Building 1155
Brooks Air Force Base, TX 78235-5000

Dear Capt. Hartford:

I was unable to attend the public hearing on the Space Nuclear Thermal Propulsion (SNTP) Program held September 8, 1992, in Las Vegas, Nevada. However, my comments on the program are as follows:

13.2 A | The Desert Research Institute (DRI) supports locating the Space Nuclear Thermal Propulsion program at the Nevada Test Site (NTS).

DRI is an environmental research division of the University and Community College System of Nevada. Under contracts with the U.S. Department of Energy, we have conducted environmental research at the NTS for a quarter of a century. Our primary programs are groundwater research and cultural resource surveys.

We believe the NTS is uniquely suited for the SNTP program because of:

a) the range and depth of expertise held by NTS contractor and government employees
b) its remote and secure location
c) its infrastructure
d) the likelihood of losing a large number of the highly educated and experienced workforce if new work is not found to replace work lost due to the decline in nuclear weapons testing

Sincerely,

James V. Taranik
President, Desert Research Institute
Director, Nevada Space Grant

JVT:mm

Document 133

SMITH & company
certified public accountants

Merrell C. Smith
David M. Smith
Brenda Shaw

September 11, 1992

Captain Scott Harford:
AFCEE/ESP
Building 1155
Brooks AFB, Texas 78235-5000

Dear Captain Harford:

The Idaho National Engineering Labratory has over 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly for future reuse or disposal as needed. All phases of the program could be done at the INEL.

13.1 A | We support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,
SMITH AND COMPANY

David M. Smith
Certified Public Accountant

480 Memorial Drive, Suite 101 Idaho Falls, Idaho 83402 208-524-5501 FAX [illegible]

Document 134

SMITH & company
certified public accountants

Merrell C. Smith
David M. Smith
Brenda Shaw

September 11, 1992

Captain Scott Harford:
AFCEE/ESP
Building 1155
Brooks AFB, Texas 78235-5000

Dear Captain Harford:

The Idaho National Engineering Labratory has over 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion.

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A We support this program and encourage your support to locate this
13.1 technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,
SMITH AND COMPANY

Merrell C. Smith
Certified Public Accountant

400 Memorial Drive, Suite 101 Idaho Falls, Idaho 83402 208-524-2681 FAX 522-0602

Document 135

SMITH & company
certified public accountants

Merrell C. Smith
David M. Smith
Brenda Shaw

September 11, 1992

Captain Scott Harford:
AFCEE/ESP
Building 1155
Brooks AFB, Texas 78235-5000

Dear Captain Harford:

The Idaho National Engineering Labratory has over 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A We support this program and encourage your support to locate this
13.1 technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,
SMITH AND COMPANY

Brenda Shaw
Certified Public Accountant

400 Memorial Drive, Suite 101 Idaho Falls, Idaho 83402 208-524-2681 FAX 522-0602

Document 136

ELECTRICAL WHOLESALE SUPPLY CO INC
"COMMITTED TO EXCELLENCE"

09/12/92

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

A After giving careful study to the proposed Space Nuclear Thermal Propulsion Technology
13.1 program being sited at the INEL, we strongly favor such a possible decision. The impact on the environment is regarded by our company and its employees as acceptable.

The ability and expertise of the labor force at the INEL and their leading role as a nuclear research facility is recognized internationally. We think it is important for the U S A. to continue its leadership in space exploration. The spin-off technologies and industries resulting from such a project could be dramatic. When you couple the possibilities of this proposed project with the capabilities of INEL staff and do it with minimal environmental impact and with broad community support, we think this could be a winning team.

Sincerely,

HAROLD W. DAVIS
Chairman Board of Directors

Document 137

Please mail this form to:

AFCEE/ESEP
Attn: Capt. Scott Hartford
Building 1155
Brooks Air Force Base, TX 78235-5000

PUBLIC HEARING WRITTEN COMMENT SHEET

Space Nuclear Thermal Propulsion (SNTP) Program

I was unable to attend the public hearing on the SNTP Program held September 8, 1992, in Las Vegas, Nevada. However, my comments on the draft environmental impact statement, and on the program in general, are as follows:

Date: 09/11/92

Dear Capt Hartford,

A I Don't Expect To Receive Any Kind Of Employment Related To The SNTP Program But I Definitely Want To See It Happen. I'm A Big Fan Of Space Exploration & Any Associated Technologies
13.3 And Honestly Feel That This Project Would Be A Great Source Of Pride For Many Americans.

I'm Currently Working As A Research Technician At The Nevada Test Site In Area 25. This Is The Area That 30 Years Ago Was Host To The Old Nuclear Experimental Rocket (NERVA). My Late Father Worked For Rover To Support NERVA & I'd Like To Support SNTP. Good luck

Name: Jerry Fogel PO Box 69118

Address: 900 Grier Drive, Suite B. Las Vegas, NV 89193

Company/Organization Represented: Lockheed Environmental Systems & Technologies

Document 138

Please mail this form to:

AFCEE/ESEP
Attn: Capt. Scott Hartford
Building 1155
Brooks Air Force Base, TX 78235-5000

PUBLIC HEARING WRITTEN COMMENT SHEET

Space Nuclear Thermal Propulsion (SNTP) Program

I was unable to attend the public hearing on the SNTP Program held September 8, 1992, in Las Vegas, Nevada. However, my comments on the draft environmental impact statement, and on the program in general, are as follows:

Date: 12 SEP 92

A
13.3 I AM STRONGLY IN FAVOR OF THE SNTP PROGRAM. I FEEL THAT THIS IS THE ONLY PROGRAM AT THIS TIME, THAT WILL ALLOW US TO EXPLORE AND COLONIZE SPACE. MANKIND HAS ALWAYS SOUGHT NEW FRONTIERS. SPACE IS THE ONLY FRONTIER THAT LEADS TO NEW FRONTIERS AND MAJOR NEW TECHNOLOGY. WE MUST CONTINUE THE PUSH TO SPACE THAT BEGAN WITH THE LUNAR LANDING IN 1969.

Name: DANNY C. DENNIS

Address: 3623 GREENWICH DR. N. LAS VEGAS, NV 89030

Company/Organization Represented: SELF

Document 139

CITY OF IDAHO FALLS
AIRPORT
2140 NORTH SKYLINE DRIVE
IDAHO FALLS, IDAHO 83402-4806

September 14, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

THE INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A
13.1 We support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

JAMES H. THORSEN, A.A.E.
Director of Aviation

jt

Document 139

CITY OF IDAHO FALLS
AIRPORT
2140 NORTH SKYLINE DRIVE
IDAHO FALLS, IDAHO 83402-4806

TESTIMONY OF
JAMES H. THORSEN
DIRECTOR OF AVIATION
CITY OF IDAHO FALLS
BEFORE THE
UNITED STATES AIR FORCE
SPACE NUCLEAR PROJECT

The Idaho Falls Municipal Airport is prepared to and capable of supporting USAF demands for the Space Nuclear Thermal Propulsion Project.

The airfield is capable of operating virtually all size commercial and military aircraft, including the USAF/Lockheed C-5 Transport.

The airfield is equipped with an FAA owned and operated Instrument Landing System, has radar service, an FAA staffed Control Tower and Flight Service Station.

The airfield is capable of 55 instrument operations per hour, far in excess of current demand.

The Airport is served by American Airlines, Delta Air Lines, Horizon Air and Skywest Air Lines. There is excess capacity in the Terminal Facilities and the carriers can quickly add capacity (seats) via more frequent scheduling and/or larger aircraft.

Current air carrier service is with Boeing 727-200, 737-300, MD-80, EMB-120, DeHavilland Dash 8 and Metroliner aircraft. Current schedules comprise about 15 flights per day with approximately 1100 seats per day available.

American and Delta are among the top three largest airlines in the world, and offer competitive fares throughout their system. American serves 270 cities and Delta 300 around the world. Horizon and Skywest code share with their partners/owners Alaska Air Lines and Delta Air Lines.

In summary, the Idaho Falls Municipal Airport can handle demands placed upon it in support of the Space Nuclear Thermal Propulsion Project.

September 4, 1992

****

Document 140

David C. Hobson, D.D.S., M.S.
DIPLOMATE, AMERICAN BOARD OF ORTHODONTICS

Idaho Falls Dental Group

Sept. 10, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Capt. Hartford:

A
13.1 I am writing this letter in support of locating the Space Nuclear Thermal Propulsion Technology system at the INEL site in Idaho!

Although my background contains much scientific training, I am not well enough versed in nuclear physics to address questions of where the best place to locate the project would from the physical facilities perspective. However, I would like to offer some comments on the personnel aspect of things.

I am a transplanted Californian, and have spent quite a bit of time in Las Vegas, where most people employed at the Nevada Test Site live. I have never lived in an area where the people are as friendly, conscientious, and goal-oriented as the people I have worked with in Idaho Falls. After having dealt with dozens of families of INEL employees, I am firmly of the opinion that it would be impossible to find a better group of people to have associated with an important project such as this. And given the reputation for government projects to be inefficient at best, it would seem in the best interests of both the Air Force and the tax payers to locate the project in an area where the orientation of site personnel is that of hard work, and a strong ethical orientation towards honesty, efficiency, etc.

With the abundance of cultural activities, summer and winter outdoor things to do, and a community based on strong family and social values, it would seem that Idaho would also be an easy area to recruit top people to as a place to live and work.

I would respectfully ask the United States Air Force to give every consideration to the many favorable reasons for locating the S.N.T.P.T. project to the INEL site.

Thank you for your consideration!

Sincerely yours,

Convenient • Comfortable • Caring

Grand Teton Mall, 2300 East 17th Street, Idaho Falls, Idaho 83404 (208) 529-0303

Document 141

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/8/92

I am a thirty-one year resident of Las Vegas. I spent the years 1961 - 1978 working in Radiation Safety at the Nevada Test Site and have specific knowledge of the area proposed for siting the SNTP.

The Draft Environmental Impact Statement more than adequately addresses potential environmental issues.

A
13.2 In my opinion, there is absolutely no scientifically valid reason for not conducting this project at the Nevada Test Site, and I strongly support the research.

Name Duane Hall

Address 6101 Blossom Knoll — Las Vegas, NV. 89108
Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 142

ELLSWORTH BROS. INC.

September 11, 1992

Captain Scott Hartford,
AFCEE/ESEP,
Building 1155,
Brooks AFB, TX 78235-5000

Captain Hartford:

A
13.1 I would like to add my name, and those of my 24 employees, in support of the Space Nuclear Thermal Propulsion Technology to be sited in Idaho Falls, Idaho.

We believe that the INEL has the expertise necessary for this type of project. We also know that the Community supports the siting of this important project at the INEL.

We urge your support for bringing this technology to our community.

Thank you,

Jack Ellsworth Jr.
Vice-President

Document 143

Make The Climb!

September 11, 1992

Captian Scott Hartford:
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A
13.1 We support this program and encourage your support to locate this technology at the INEL. the leading nuclear research facility in the United States.

Sincerely,

Nancy D. Thorson, GRI, CRS, CREA
RE/MAX Homestead Realty

RE/MAX

Document 144

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 11 Sept 92

A
13.4 Being downwind from the Nevada test site, I am especially concerned about the possible buildup of radioactivity in the Southern Utah area (or anywhere) during the proposed 10 year life of the test/validation program.
This is especially true because the SNTP is in the engineering development phase, a phase during which many unknows will occur(reason for it) and almost anything can go wrong. My involvement(both directly and indirectly) in many development programs has demonstrated "That if it can happen, it will".
I have seen several "worse case analyses" in which a point of concern was brushed aside as not being possible, but did occur because of unforeseen events, or human error.
I feel that, even though the SNTP may be benifical from a cost/benifit analysis, the program should not go forward if it involves a program of testing/validation in an enviroment that can cause human health endangerment to those living in a area of known potential hazard.
Frankly the U S Government and its Departments and Agencies have lost their creditability as perceived by its citizens. The SNTP Draft EIS is an impressive looking document and no doubt(I was unable to review it as we in St George were not notified of its availability in the County Library for review)carries a convincing story. However, the presentation at the public hearing did nothing to convince me(or apparently anyone else present) that it was a creditible document.
Will it be less expensive and safer to launch a 20 ton payload using SNTP technology than by using a conventionally fueled rocket, or will it just be nic

Name Robert W Rands

Address 1464 Basswood Circle St George UT 84770
Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 145

City of Rexburg

STATE OF IDAHO

September 8, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Sir:

A
13.1 I will be unable to attend the hearing on September 17, 1992, in Idaho Falls on the Space Nuclear Thermal Propulsion Project. As Mayor of the City of Rexburg, I will take this opportunity to testify in favor of this project being awarded to the INEL. The INEL has a long history of nuclear experiments with an excellent safety record. I feel comfortable with their expertise and professionalism in performing the testing to determine the feasibility of nuclear space propulsion. The facilities and personnel are available and this study could be performed by the INEL in the most cost-effective manner. Please give the INEL consideration when awarding this project. They will perform well with due regard to safety and cost-effectiveness.

Sincerely,

Nile L. Boyle
Nile L. Boyle
Mayor
City of Rexburg

jw

Document 146

September 8, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

A
13.1 Please allow this letter to express my support for the placement of the Space Nuclear Propulsion Program at the INEL.

This community is very supportive of INEL projects and we hope that support, coupled with the INEL excellent 40 year history in nuclear safety testing weighs heavily toward a favorable decision.

The INEL is a leader in nuclear research in the United States and we would appreciate your support.

Sincerely,

Robert W. Barnes
381 Gustafson Dr.
Idaho Falls, Idaho 83402

Document 147

Please mail this form to:

AFCEE/ESEP
Attn: Capt. Scott Hartford
Building 1155
Brooks Air Force Base, TX 78235-5000

PUBLIC HEARING WRITTEN COMMENT SHEET

Space Nuclear Thermal Propulsion (SNTP) Program

I was unable to attend the public hearing on the SNTP Program held September 8, 1992, in Las Vegas, Nevada. However, my comments on the draft environmental impact statement, and on the program in general, are as follows:

Date: 9-9-92

A
13.2 I feel that SNTP should be located in Las Vegas, because the technical expertise is already here and many facilities at the Nevada Test Site are coming available for use.

Name: Douglas Seastrand

Address: 6440 Spanish Garden Ct.

Company/Organization Represented: EG&G / Sandia Support

Document 148

International Brotherhood of Electrical Workers

Local Union 357 - Las Vegas, Nevada

MAILING ADDRESS
4321 E. Bonanza
Las Vegas, NV 89110

TELEPHONE
[illegible]
Area Code 702
FAX [illegible]

September 9, 1992

AFCEE/ESE
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Dear Sir:

I enjoyed your presentation here in Las Vegas on September 8, 1992 on the Draft Environment Impact statement for Space Nuclear Thermal Propulsion Program.

A
13.2 I am a representative of the Electrical Workers, Local 357, IBEW, Las Vegas, Nevada and we would appreciate your consideration in placing the testing facility at the Nevada Test Site. We can provide qualified electricians to do the work needed in the building and maintaining of the Project.

Your Public Hearing Team did a good job.

Yours truly,

Bob W. Barker
Bob W. Barker
Assistant Business Manager
LOCAL UNION 357, IBEW

BWB/jl

Document 149

Please mail this form to:

AFCEE/ESEP
Attn: Capt. Scott Hartford
Building 1155
Brooks Air Force Base, TX 78235-5000

PUBLIC HEARING WRITTEN COMMENT SHEET

Space Nuclear Thermal Propulsion (SNTP) Program

I was unable to attend the public hearing on the SNTP Program held September 8, 1992, in Las Vegas, Nevada. However, my comments on the draft environmental impact statement, and on the program in general, are as follows:

Date: Sept. 9, 1992

The DEIS was very comprehensive. The analysis which went into it's preparation seemed to be exhaustive. I am completely satisfied that the safety concerns relating to the proposed project have throughly been taken into account.

A 13.2 I would like to see the SNTP program implemente preferably at the NTS. (I do consider the CTF to be a suitable alternative.)

Name: Robert B. Steenbergen

Address: 1926 Hobson Drive, Henderson, NV 89014

Company/Organization Represented: EG&G/Energy Measurements

Document 150

291.17

Please mail this form to:

AFCEE/ESEP
Attn: Capt. Scott Hartford
Building 1155
Brooks Air Force Base, TX 78235-5000

PUBLIC HEARING WRITTEN COMMENT SHEET

Space Nuclear Thermal Propulsion (SNTP) Program

I was unable to attend the public hearing on the SNTP Program held September 8, 1992, in Las Vegas, Nevada. However, my comments on the draft environmental impact statement, and on the program in general, are as follows:

Date: 9/9/92

A 13.2 I fully support both the SNTP and the Space [illegible] Program. Further, the SNTP should be conducted at the site that already has the security and testing apparatus in place -- the Nevada Test Site.

The Nevada Test Site is the best place to conduct the SNTP for another reason - with the moratorium on nuclear testing, a trained and dedicated work force is already in place. They can transition to this new program with a minimum of extra training. Bottom line: Conduct the Testing - in Nevada!!

Name: S. Mayo

Address: Po Box 1912 M/S C1-105, Las Vegas, NV 89125

Company/Organization Represented: Concerned citizen

Document 151

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sept. 21 1992

A 13.1 Having reviewed the Draft SNTP EIS, it is quite clear to me that my tax dollars would be better spent at the INEL. It appears that the projected project cost [illegible] significantly less if the program were to be carried out at the Idaho facility.

The safety record at the INEL is impeccable. Safety at all levels within the community, personnel and environmental safety is the number one priority. Community safety and a commitment to quality has resulted in the INEL's impressive repertoire of successful nuclear programs over the past years and the users can be assured that these values will remain the success of the SNTP as well.

Name James J. [illegible]

Address 605 Lomax, Idaho Falls Idaho 83401

Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 152

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: SEPT 20, 1992

Thank you for the opportunity to comment in favor of the SNTP. I am a retired nuclear submarine captain who presently works for EG&G. Over 30 years ago, a tradition of success in pushing the leading edge of reactor technology [illegible] the Department of Defense began with the S1W reactor prototype. It gave the submarine force a competitive edge in technology which it has maintained continuously and [illegible] against any potential adversary. I was fortunate to

A 13.1 be the beneficiary of that technology. Space will play an even bigger role in the future of defense. It is entirely appropriate that the SNTP be developed at the INEL, a [illegible] in bringing [illegible] reactor technology for defense. John H Cox

Name JOHN H COX

Address 711 E. COUNTRYSIDE LANE IDAHO FALLS, ID 83404

Street Address / City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 153

[redacted]
STATE UNIVERSITY

Office of the President
[illegible]
Pocatello, Idaho
[illegible]
(208) [illegible]
FAX (208) [illegible]

September 21, 1992

AFCEE/ESNP
Attn: Capt. Scott Hartford
Brooks Air Force Base, TX 78235-5000

To Whom It May Concern:

A 13.1 Idaho State University supports the effort to develop nuclear propulsion systems at the Idaho National Engineering Laboratory. The expertise in nuclear power at the INEL and the long history of safe operations over the years gives us confidence in the choice of INEL for this important project.

We believe that the continued development of science programs at ISU depends to some extent on the health of the INEL. There are a number of joint research projects between our two organizations. Some of the strengths the university can bring to support the project are in our Nuclear Science and Engineering and our Applied Physics programs. We also enjoy an excellent working relationship with other research universities throughout the region.

ISU operates a number of educational programs in direct support of the INEL including

1. Ph.D. in Nuclear Science and Engineering
2. Interdisciplinary M.S. in Waste Management
3. B.S. in Health Physics
4. MBA and BBA in Business Administration.

We believe that the INEL represents an unparalleled resource for the design and testing of space Nuclear Propulsion Systems, and urge the Air Force to select them for that role.

Sincerely,

Richard L. Bowen
President

RLB:bg

ISU Is An Equal Opportunity Employer

Document 154

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: September 9, 1992

My name is Howard W. Dickson. I am the Deputy General Manager at Reynolds Electrical & Engineering Co., Inc. (REECo). I speak as a local citizen from Las Vegas. I have over 25 years of experience with nuclear reactors and related facilities. My specialty is radiation safety. I have a degree in Physics and I am certified by several national professional health and safety organizations. I have been a senior reactor operator. My experience tells me that our biggest risk associated with the Space Nuclear Thermal Propulsion Program is ignorance and fear of the unknown. I am confident that the technical challenges associated with this program can be met and overcome in a safety and environmentally sound manner. We have the knowledge and skilled labor at the

A 13.2 Nevada Test Site (NTS) to support the Air Force on this program, with negligible impact on the health and safety of workers and the general public. I hope the Air Force chooses the NTS if and when Particle Bed Reactor (PBR) validation tests are conducted.

Name: Howard W. Dickson

Address: Reynolds Electrical & Engineering Co., Inc.
Post Office Box 98521, M/S 555 Las Vegas, NV 89193-8521

Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESNP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 155

"FOR THE PUBLIC"
TOTAL SIGNATURES = 458

PETITION

A 13.4 We, the followin[g] ... all elected represent[atives] ... [PROPULSION PROGRAM] (N ... PROGRAM MAY EXPOSE TH[E] ... ENVIRONMENTAL RISKS. ... ON DOWN-TO-EARTH ISSU[ES] ... AFFORDABLE HEALTH CAR[E] ... HOMELESS, AIDS AND CA[NCER] ... ABOUT THE DANGERS OF DRUGS.

Seth Simon
(801) 628-6959

...s, respectfully urge ... E SPACE NUCLEAR THERMAL ... IND). THIS PROPOSED ... TO UNNECESSARY ... EY CAN BE BETTER SPENT ... RELIEF, JOBS, ... , HOUSING FOR THE ... DUCATING OUR POPULATION

NAME	CITY	STATE
1. Dennis W McLean	Ivins	UT
2. [illegible]	[illegible]	UT
3. [illegible]	St George	UT
4. [illegible]	St George	UT
5. [illegible]	[illegible]	UT
6. [illegible]	Washington	UT
7. [illegible]	[illegible]	UT
8. [illegible]	Hurricane	UT.
9. [illegible]	[illegible]	Utah
10. [illegible]	Hurricane	UT
11. [illegible]	St George	UT
12. Allen [illegible]	St George	UT
13. Elaine N. [illegible]	[illegible]	[illegible]
14. [illegible]	Salt Lake	UT
15. [illegible]	Salt Lake	UT

NOTARY PUBLIC/WITNESS

NOTARY SEAL — STATE OF UTAH

Document 155

4

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

NAME	CITY	STATE
1. [illegible]	SL	Utah
2. [illegible] Rosen	SLC	Utah
3. [illegible]	SLC	UT
4. [illegible]	SLC	UT
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		

NOTARY PUBLIC/WITNESS

NOTARY PUBLIC — NOTARY SEAL — St George, UT — STATE OF UTAH

Document 155

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Victoria [illegible]	Ogden	Utah
2.	[illegible]	Ogden	Utah
3.	Meg Cowley	Sandy	Utah
4.	[illegible]	SLC	Utah
5.	[illegible]	SLC	UTAH
6.	[illegible]	SLC	Utah
7.	[illegible]	SLC	Utah
8.	Barbara [illegible]	SLC	Utah
9.	[illegible]	SLC	UT
10.	[illegible]	SLC	UT
11.	[illegible]	SLC	UT
12.	[illegible]	SLC	UT
13.	[illegible]	SLC	UT
14.	Milton [illegible]	SLC	UT
15.	Merrill [illegible]	SLC	UT

[illegible]
NOTARY PUBLIC/WITNESS

NOTARY PUBLIC Comm. Exp. 3-27-93 NOTARY SEAL St. George UT 84770 STATE OF UTAH

Document 155

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible] Moore	Bountiful	Utah
2.	Brett Moore	Bountiful	UT
3.	Katherine [illegible]	SLC	UT
4.	Tom Dalton	SLC	UT
5.	[illegible] Michaels	Lehi	UT
6.	[illegible]	SLC	UT
7.	[illegible]	SLC	UTAH
8.	[illegible]		
9.	[illegible]	SLC	UTAH
10.		"	"
11.	[illegible]	SLC	UTAH
12.	[illegible]	SLC	Utah
13.	[illegible]	"	"
14.	Evelyn Richards	Park City	"
15.	[illegible]	SLC	UT

I am for this

[illegible]
NOTARY PUBLIC/WITNESS

NOTARY PUBLIC Comm. Exp. 3-27-93 NOTARY SEAL 312 S Spruce Cir St. George UT 84770 STATE OF UTAH

Document 155

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	SLC	UT
2.	[illegible]	"	"
3.	[illegible]	"	"
4.	~~[illegible]~~	~~SLC~~	~~UT~~
5.	[illegible]	SLC	UT
6.	[illegible]	[illegible]	UT
7.	[illegible]	S.L.C.	UT
8.	A. Davies	SLC	UT
9.	[illegible]	SLC	UT
10.	Beverly [illegible]	SLC	UT
11.	Edward [illegible]	SLC	UT
12.	[illegible]	SLC	Utah
13.	[illegible]	SLC	UT
14.	[illegible]	SLC	UT
15.	[illegible]	[illegible]	—

[illegible]
NOTARY PUBLIC/WITNESS

NOTARY PUBLIC Comm. Exp. 3-27-93 NOTARY SEAL St. George UT 84770 STATE OF UTAH

Document 155

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	[illegible]	[illegible]
2.	[illegible]	[illegible]	[illegible]
3.	[illegible]	SLC	Utah
4.	[illegible]	SLC	UT
5.	Matthew D. [illegible]	SLC	UT
6.	[illegible]	SLC	UTAH
7.	[illegible]	[illegible]	[illegible]
8.	[illegible]	[illegible]	UT
9.	David Martin	SLC	UT
10.	[illegible]	SLC	UT
11.	[illegible]	[illegible]	[illegible]
12.	[illegible]	SLC	UT
13.	[illegible]	SLC	UT
14.	[illegible]	[illegible]	[illegible]
15.	[illegible]	SLC	"

[illegible]
NOTARY PUBLIC/WITNESS

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	SLC	Ut
2.	[illegible]	SLC	Ut
3.	[illegible]	SLC	Ut
4.	[illegible]	SLC	UT
5.	Nancy Johns	SLC	UT
6.	[illegible]	SLC	UT
7.	[illegible]	SLC	UT
8.	James Barker	SLC	Ut
9.	Victoria C. Williams	SLC	Ut
10.	[illegible]	SLC	Ut
11.	[illegible]	SLC	Ut
12.	Susan Elliott	SLC	Ut
13.	[illegible]	SLC	Ut
14.	[illegible]	SLC	[illegible]
15.	Tom [illegible]	SLC	UT

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives : OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Brad Lewis	Leeds	Utah
2.	[illegible]	[illegible]	[illegible]
3.	[illegible]	Leeds	Utah
4.	[illegible]	Leeds	Utah
5.	Dolores [illegible]	Leeds	Utah
6.	[illegible]	Leeds	Utah
7.	[illegible]	Leeds	Utah
8.	Phillip [illegible]		
9.	[illegible]	St George	Utah
10.	[illegible]	Salt Lake C.	Utah
11.	[illegible]	Salt Lake City	Utah
12.	[illegible]	Salt Lake City	Utah
13.	[illegible]	SLC	Ut
14.	[illegible]	SLC	[illegible]
15.	[illegible]	[illegible]	[illegible]

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NOTARY PUBLIC Comm. Exp. 3-27-96 LAUREL [illegible] NOTARY SEAL 3121 S Spruce Cir St.George, UT 84770 STATE OF UTAH

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	SLC	Utah
2.	[illegible]	[illegible] SLC	Ut.
3.	[illegible]	SLC	UT
4.	Sylvia Larsen	SLC	UT
5.	[illegible]	SLC	UT
6.	[illegible]	SLC	UT
7.	[illegible]	Sandy	UT
8.	[illegible]	SLC	UT
9.	[illegible]	SLC	UT
10.	[illegible]	SLC	UT
11.	[illegible]	[illegible]	[illegible]
12.	[illegible]	SLC	Ut
13.	[illegible]	S.L.C.	UT
14.	[illegible]	S.L.C.	UT
15.	[illegible]	SLC	UT

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NOTARY PUBLIC Comm. Exp. 3-27-96 LAUREL [illegible] NOTARY SEAL 3121 S Spruce Cir St.George, UT 84770 STATE OF UTAH

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	SLC	UT
2.	Betty [illegible]	SLC	UT
3.	[illegible]	SLC	UT
4.	[illegible]	SLC	UT
5.	[illegible]	SLC	UT
6.	[illegible]	[illegible]	[illegible]
7.	[illegible]	SLC	Ut
8.	[illegible]	SLC	UT
9.	[illegible]	SLC	UT
10.	[illegible]	SLC	UT
11.	[illegible]	"	"
12.	[illegible]	Murray	Ut
13.	[illegible]	SLC	Ut
14.	[illegible]	SLC	Ut
15.	[illegible]	SLC	UT

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	[illegible]	[illegible]
2.	[illegible]	SLC	UTAH
3.	[illegible]	SLC	UT
4.	[illegible]	SLC	[illegible]
5.	[illegible]	S.L.C.	UT
6.	[illegible]	SLC	UT
7.	[illegible] (Ruth R. Harris)	SLC	Ut
8.	Muriel H. Zwick	SLC	[illegible]
9.	[illegible]	SLC	[illegible]
10.	Metti Sonnet	SLC	UT
11.	[illegible]	SLC	Ut
12.	[illegible]	SLC	UT
13.	[illegible] Zimkowski	SLC	Ut
14.	[illegible] Simonich	SLC	UT
15.	[illegible]	[illegible]	[illegible]

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Jennifer Stevens	SLC	Ut
2.	[illegible] Leppard	SLC	Ut
3.	[illegible] Schaefer	SLC	UT
4.	[illegible]	SLC	Ut
5.			
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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Dan Olson	S.L.C.	Utah
2.	Walker [illegible]	SLC	Utah
3.	David R. Brown	Salt Lake City	Utah
4.	[illegible]	SLC	Utah
5.	[illegible]	S.L.C.	UT
6.	[illegible]	Murray	UT
7.	[illegible]	Holladay	UT
8.	[illegible]	Sandy	UT
9.	Kris [illegible]	Sandy	ut
10.	E. [illegible]	" "	UT
11.			
12.			
13.			
14.			
15.			

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Clark P. Russell	SLC	UT
2.	Ruth P. Milner	SLC	UT
3.	Chris Russell	SLC	UT
4.	Roland C. [illegible]	SLC	UT
5.	Ciar Osborn	SLC	UT
6.	[illegible]	SLC	UT
7.	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~
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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	SLC	Ut
2.	[illegible]	SLC	UT
3.	Laura B Barowitz	SLC	Ut
4.	Tam Brown	SLC	UT
5.	[illegible]	"	"
6.	[illegible]	Sandy	Ut
7.	Verna Jalad	SL	UT
8.	Ellen Closson	SLC	Ut
9.	Francisco Vargas Bracam	SANDY	UT
10.	[illegible]	SLC	Ut
11.	[illegible]	SLC	UT
12.	[illegible]	SLC	UT
13.	Dana Dee	Bountiful	UT
14.			
15.			

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	SLC	UT
2.	[illegible]	SLC	UTAH
3.	[illegible]	SLC	Utah
4.	Michael Edgerton	SLC	Utah
5.	[illegible]	SLC	Utah
6.	[illegible]	SLC	Ut
7.	[illegible]	SLC	UT
8.	[illegible]	Midvale	Ut
9.	[illegible]	SLC	UT
10.	Richard McDonough	MIDVALE	UT
11.	[illegible]	Bluffdale	UT
12.	Mildred Locke	Hurricane	Ut
13.	[illegible]	Hurricane	UT
14.	[illegible]	Veyo	UT
15.	Ralph Bingham	St George	Utah

[illegible]
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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE MEXICAN-CANADIAN FREE TRADE AGREEMENT THAT HAS BEEN SIGNED BY PRESIDENT BUSH, AUGUST 1992, BUT HAS TO BE APPROVED BY CONGRESS. 7.8% or 10 MILLION AMERICAN WORKERS ARE UNEMPLOYED, THE REAL NUMBER MAY BE TWO OR THREE TIMES HIGHER. OUR NATION CAN NOT AFFORD TO LOSE MILLIONS OF JOBS TO MEXICO AND CANADA WITH NO GUARANTEE THAT WE WILL BENEFIT FROM THE AGREEMENT.

	NAME	CITY	STATE
1.	Edgar A. McElvain	Hesperia	CA
2.	Steve Olds	St George	Ut
3.	[illegible]	St. Geo.	
4.	[illegible]	Washington	Ut
5.	[illegible]	St Geo	Ut.
6.	[illegible] Smith	St Geo.	Ut.
7.	Ron Smith	St George	UT
8.	[illegible]	St Geo.	Ut
9.	Lloyd [illegible]	St George	UT
10.	[illegible]	St George	UT
11.	[illegible]	ST George	UT
12.	[illegible]	Washington	[illegible]
13.	[illegible]	Washington	Utah
14.	[illegible] Williams		
15.	[illegible]	Washington	Utah

[illegible]
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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE MEXICAN-CANADIAN FREE TRADE AGREEMENT THAT HAS BEEN SIGNED BY PRESIDENT BUSH, AUGUST 1992, BUT HAS TO BE APPROVED BY CONGRESS. 7.8% or 10 MILLION AMERICAN WORKERS ARE UNEMPLOYED, THE REAL NUMBER MAY BE TWO OR THREE TIMES HIGHER. OUR NATION CAN NOT AFFORD TO LOSE MILLIONS OF JOBS TO MEXICO AND CANADA WITH NO GUARANTEE THAT WE WILL BENEFIT FROM THE AGREEMENT.

	NAME	CITY	STATE
1.	John W Daniels	St George	Utah
2.	O M Buchanan	St George	Ut
3.	[illegible]	St George	Ut
4.	[illegible]	CHURCHVELS	UT.
5.	[illegible]	St George	Ut
6.	Robert Brown	ST. Geo.	UTAH
7.	[illegible]	St George	Ut.
8.	[illegible]	St. George	Ut.
9.	[illegible]	St George	Ut
10.	[illegible]	St George	UT
11.	[illegible] Alexander	St George	UT
12.			
13.			
14.			
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[illegible]
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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	St George	UT
2.	[illegible]	St George	UT
3.	[illegible]	ST GEORGE	UT
4.	Barbara Weakley	Vegas	ut
5.	Michelle Fleming	St. George	UT
6.	[illegible] Russell	St Geog	UT
7.	[illegible]	[illegible]	Utah
8.	[illegible] Bayer	Santa Clara	Utah
9.			
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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	St. Geog	Ut.
2.	[illegible]	St Geog	UT
3.	[illegible]	St George	Ut.
4.	[illegible]	St George	ut
5.	[illegible]	St. George	Ut
6.	[illegible]	[illegible]	UT
7.	[illegible]	St Geog	Ut
8.	[illegible]	St George	ut
9.	[illegible]	"	"
10.	[illegible]	" "	"
11.	Cathy Fowler	" "	" "
12.	[illegible]	"	"
13.	[illegible]	St Geo	ut
14.	Glen Gardner	St Geo	ut
15.	Robert A. Johnson	St. Geo	Ut

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	St George	UT
2.	[illegible]	" "	" "
3.	[illegible]	St. George	UT
4.	[illegible]	St George	Ut
5.	[illegible]	St. George	Ut
6.	[illegible]	St. George	Ut.
7.	[illegible]	St. George	"
8.	[illegible]	"	
9.	[illegible]	"	
10.	Marci Jensen	"	UT
11.	[illegible]	"	'
12.	[illegible]	"	'
13.	[illegible]	St George	UT
14.	[illegible]	St George	Utah
15.	[illegible]	St George	[illegible]

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	Leeds	Ut.
2.	[illegible]	Leeds	Ut.
3.	[illegible]	Leeds	Ut
4.	[illegible]	Leeds	UT
5.	[illegible]	Leeds	Ut.
6.	[illegible]	Leeds	UT
7.	[illegible]	Leeds	UT.
8.	[illegible]	Leeds	Ut.
9.	[illegible]	Leeds	Ut.
10.	[illegible]	Leeds	Ut.
11.	[illegible]	Leeds	Ut
12.	[illegible]	[illegible]	Ut
13.	[illegible]	St George	Ut.
14.	[illegible]	"	"
15.	[illegible] M. Daniels	"	"

NOTARY PUBLIC/WITNESS [signature]

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Anita Huff	[illegible]	Utah
2.	[illegible] Huff	Hurricane	Utah
3.	[illegible] McDonald	Toquerville	Utah
4.	[illegible]	Toquerville	Ut.
5.	[illegible] Williamson	Paragonah	Ut
6.	Linda [illegible]	Cedar City	UT
7.	Mary Jane [illegible]	Cedar City	Utah
8.	Ernest L. King	Washington	Utah
9.	[illegible] Davis	Wash	Utah
10.			
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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	St. George	Utah
2.	[illegible]		"
3.	[illegible]	St. George	
4.	[illegible]	St. George	
5.	[illegible]	[illegible]	[illegible]
6.	[illegible]	St. George	Utah
7.	[illegible]	St. George	Utah
8.	[illegible]	Hurricane	UT
9.	[illegible]	Hurricane	UT
10.	[illegible]	St. George	[illegible]
11.	[illegible] Wolfe	St. George	UT
12.	[illegible]	Santa Clara	UT
13.	[illegible]	St. George	UT
14.	Patricia A. [illegible]	Cedar City	Utah
15.	[illegible]	Cedar City	UT

NOTARY PUBLIC/WITNESS

NOTARY PUBLIC — Comm. Exp. 3-27-95 — LAUREL STINSON — St. George, UT 84770 — STATE OF UT. — SEAL

Document 155

17

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Ina Blake	St. George	Utah
2.	[illegible]	St. George	Utah
3.	[illegible]	[illegible]	Utah
4.	Carol [illegible]	Santa Clara	Utah
5.	Jack Daniels		
6.	D Parkinson		
7.	[illegible]	St. George	Utah
8.	[illegible]	St. George	Utah
9.	[illegible]	Salt Lake City	Utah
10.	[illegible]	St. George	Utah
11.	[illegible]	St. George	Utah
12.	[illegible]	St. George	Ut
13.	[illegible]	St. George	UT.
14.	[illegible]	St. George	UT
15.	[illegible]	St. Geo	UT

[illegible] Washington Utah

NOTARY PUBLIC/WITNESS

NOTARY PUBLIC — LAUREL STINSON — St. George, UT 84770 — STATE OF UTAH

Document 155

(5)

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	St. George	Utah
2.	[illegible]	St. George	Utah
3.	[illegible]	Magna	Utah
4.	[illegible]	Salt Lake City	Utah
5.	Allen E. [illegible]	St. George	Utah
6.	Dorothy W. [illegible]	St. George	Utah
7.	[illegible]	St. George	Utah
8.	[illegible] Palmer	St. George	Utah
9.	[illegible] Palmer	St. George	Utah
10.	[illegible]	St. George	Utah
11.	[illegible]	St. George	UT
12.	[illegible]	Salt Lake	Ut.
13.	[illegible]	" "	"
14.	[illegible] McAllister	St. George	Ut.
15.	[illegible] McAllister	"	"

NOTARY PUBLIC/WITNESS

NOTARY PUBLIC — Comm. Exp. 3-27-95 — LAUREL STINSON — St. George, UT 84770 — STATE OF UTAH — SEAL

Document 155

(5)

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Eleanor Stockman	Washington	Ut
2.	[illegible]		
3.	[illegible]		
4.	William [illegible]	St George	Ut
5.	[illegible]	St George	Ut
6.	[illegible] Talbot	Santa Clara	ut
7.	Ella Talbot	"	"
8.	[illegible]	St George	UT
9.	[illegible]	St George	Utah
10.	[illegible]	Wash	Utah
11.	[illegible]	[illegible]	utah
12.	[illegible]	Ogden	utah
13.	[illegible]	St. George	Utah
14.	[illegible]	St George	Utah
15.	[illegible]	St George	Utah

[signature]
NOTARY PUBLIC/WITNESS

NOTARY PUBLIC — Comm. Exp. 3-27-93 — NOTARY SEAL — STATE OF UTAH

Document 155

(5)

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]	845 N. Valley Dr 603	Ut.
2.	[illegible]	2072 W 1600 N	
3.	[illegible]	[illegible]	
4.	[illegible]	1015 So [illegible]	
5.	[illegible] Villanueva	86 N. 700 W.	
6.	[illegible]	[illegible]	
7.	[illegible]	[illegible]	
8.	[illegible]	[illegible]	
9.	[illegible]	St Geo	Utah
10.	[illegible]	St George	Utah
11.	[illegible]	St. George	Utah
12.	[illegible]	1525 [illegible]	
13.	[illegible]	Roy	Utah
14.	[illegible]	Roy	Ut.
15.	[illegible]	Ogden	Utah

[signature]
NOTARY PUBLIC/WITNESS

NOTARY PUBLIC — Comm. Exp. 3-27-93 — NOTARY SEAL — STATE OF UTAH

Document 155

(5)

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Charlotte A. [illegible]	St. George	Utah
2.	[illegible]	St George	Utah
3.	[illegible]	St. George	Utah
4.	Mabel J. Robertson	St George	Utah
5.	[illegible] Robertson	St George	Utah
6.	[illegible]	St. George	Utah
7.	[illegible] Hewett	St. George	Utah
8.	Clyde [illegible] Hewett	St. George	Utah
9.	[illegible]	St George	Utah
10.	[illegible]	St George	Utah
11.	[illegible]	St George	Utah
12.	[illegible]	St George	Utah
13.	[illegible]	St George	Utah
14.	[illegible]	St George	Utah
15.	[illegible] Mitchell	St George	Utah

[signature]
NOTARY PUBLIC/WITNESS

NOTARY PUBLIC — Comm. Exp. 3-27-93 — NOTARY SEAL — STATE OF UTAH

Document 155

(5)

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Eva Romero	St George	Utah
2.	[illegible]	-	-
3.	[illegible]	-	-
4.	[illegible]	"	"
5.	[illegible]	Washington	utah
6.	[illegible]	-	-
7.	Jay Marshall	St George	UT
8.	[illegible] H PARKER	St George	Ut
9.	[illegible] Zaragoza	St George	Utah
10.	[illegible]	" "	"
11.	[illegible]	Washington	utah
12.	[illegible]	St George	Utah
13.	Robert H Brown	"	"
14.	[illegible]	St George	Utah
15.	[illegible]	[illegible] N 1050 W	Utah

[signature]
NOTARY PUBLIC/WITNESS

NOTARY PUBLIC — Comm. Exp. 3-27-93 — NOTARY SEAL — STATE OF UTAH

Document 155

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Verle Brown	St George	Utah
2.	Clifford Rice	[illegible]	Utah
3.	Wm B Johnson	St George	Utah
4.	Lina Johnson	St George	Utah
5.	Joe Rapparo	St George	Utah
6.	[illegible]	St George	UT
7.	Robert Haun	St. George	Ut
8.	Eleanor Stockman	Washington	Ut
9.	[illegible]	St George	UT
10.	Frances Thurston	" "	"
11.	Alice Adams	Irvine	St George, Utah
12.	Bea Wallis		St Geo
13.	Helen Willis		St Geo
14.	Eugene Brackett	St. Geo	Utah
15.	John Smith	St Geo	Utah

[illegible signature]
NOTARY PUBLIC/WITNESS

NOTARY PUBLIC
Comm. Exp. 3-27-93
LAUREL [illegible]
3421 S. Spruce Cir.
St. George, UT 84770
STATE OF UTAH
SEAL

Document 155

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	[illegible]		
2.	[illegible] Scott	St George	Ut
3.	[illegible] Scott	St George	Utah
4.	[illegible]	Nashville	[illegible]
5.	[illegible]	" "	
6.	[illegible]	St George	Utah
7.	[illegible]	St George	UT
8.	[illegible]	Washington	Ut
9.	Orson L Scott	St George	Utah
10.	Emily E. Scott	St George	Utah
11.	Jennie S. Francom	St George	Ut
12.	Evelyn Brakley	" "	"
13.	[illegible]	" "	"
14.	Rod Medlyn	ST. George	Utah
15.			

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NOTARY PUBLIC/WITNESS

NOTARY PUBLIC
Comm. Exp. 3-27-93
LAUREL [illegible]
3421 S. Spruce Cir.
St. George, UT 84770
STATE OF UTAH
SEAL

Document 155

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PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Louise Matthews	St. George	Utah
2.	George Matthews	St George	Utah
3.	Ray Robertson	St. George	Utah
4.	John Griffin	St George	Utah
5.	(RALPH) George W. Putnam	St George	Utah
6.	Reese Putnam	St George	Utah
7.	Oscar W. Welker	St George	Utah
8.	Alice H Welker	St George	Utah
9.	Michael J Kelly	St George	Utah
10.	[illegible]	St George	Utah
11.			
12.			
13.			
14.			
15.			

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NOTARY PUBLIC/WITNESS

NOTARY PUBLIC
Comm. Exp. 3-27-93
LAUREL [illegible]
3421 S. Spruce Cir.
St. George, UT 84770
STATE OF UTAH
SEAL

Document 155

8

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Kevin R Kolbe	St Geo	Ut. 84770
2.	[illegible]	St. George	UT 84770
3.	Kim A Paddock	St George	UT 84770
4.	E. Clara Bell	St George	Utah 84770
5.	Wilma Jacobs	St George	Utah
6.	John H Jacobs	St George	Utah
7.	Arthur W. McRae	Bountiful	Utah 84010
8.	Ruth R. McRae	Bountiful	Ut 84010
9.			
10.			
11.			
12.			
13.			
14.			
15.			

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NOTARY PUBLIC/WITNESS

NOTARY PUBLIC
Comm. Exp. 3-27-93
LAUREL [illegible]
3421 S. Spruce Cir.
St. George, UT 84770
STATE OF UTAH
SEAL

Document 155

5)

PETITION

We, the following undersigned citizens, respectfully urge all elected representatives to: OPPOSE THE SPACE NUCLEAR THERMAL PROPULSION PROGRAM (NUKE ROCKET OR TIMBERWIND). THIS PROPOSED PROGRAM MAY EXPOSE THE RESIDENTS OF UTAH TO UNNECESSARY ENVIRONMENTAL RISKS. THE TAX PAYER'S MONEY CAN BE BETTER SPENT ON DOWN-TO-EARTH ISSUES SUCH AS HURRICANE RELIEF, JOBS, AFFORDABLE HEALTH CARE, QUALITY EDUCATION, HOUSING FOR THE HOMELESS, AIDS AND CANCER RESEARCH, AND EDUCATING OUR POPULATION ABOUT THE DANGERS OF DRUGS.

	NAME	CITY	STATE
1.	Seth Jarvis	SLC	Ut
2.	Brenda Erlinger	SLC	UT
3.	Dan Woolley	S.L.C	Ut
4.	[illegible] Morgan	S.L.C	Ut
5.	[illegible]	S.L.C.	UTAH
6.	DAVID KUNZ	S.L.C.	UTAH
7.	[illegible]	SLC.	Utah
8.	[illegible]	SLC	Utah
9.	[illegible] M. Rogers	SLC	Utah
10.	Alex Spencer	SLC	Utah
11.	Wilma Odell	SLC	UT
12.	[illegible]	SLC	UT
13.	[illegible]	SLC	UT
14.	[illegible]	SLC	Ut
15.	Daniel S. Wall	SLC	Ut.

[illegible]

NOTARY PUBLIC/WITNESS

NOTARY PUBLIC · Comm. Exp 3-27-93 · LAUREN STINSON · NOTARY SEAL · 3121 E Sirus Cr · St. George, UT 84770 · STATE OF UTAH

Document 156

9/10/92

SIR,

I WOULD LIKE TO GET A COPY OF THE 'DRAFT ENVIRONMENTAL IMPACT STATEMENT' ON THE 'SPACE NUCLEAR THERMAL PROPULSION PROGRAM'. ALSO I WOULD LIKE TO GET ON THE MAILING LIST FOR PUBLICATIONS RELATING TO THIS PROGRAM. I HAVE FOLLOWED THIS PROGRAM WITH GREAT INTEREST THE PAST FEW YEARS AND WOULD LIKE TO WATCH ITS FUTURE DEVELOPMENT. THANK YOU FOR YOUR TIME AND ANY HELP YOU MAY BE ABLE TO GIVE ME. I AM LOOKING FORWARD TO COMMENTING ON THIS PROCESS AND APPRECIATE THE CHANCE TO DO SO.

SINCERELY,

JOHN KAMERER
618 10TH AVE.
CLARKSTON, WASH.
99403

(?)

Document 157

October 3, 19
Park City, U

Captain Scott Hartford.

A
13.4 Im writing to ask you to not test missiles with nuclear power. I don't like the idea and think it is totally unnecessary.

Sincerely,

Evelyn M. Richards
P.O.B. 1355
Park City, Utah 8

Document 158

IDAHO STATE HISTORICAL SOCIETY

CECIL D. ANDRUS, Governor

September 30, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks Air Force Base, Texas 78235-5000

RE: Draft Environmental Impact Statement - Space Nuclear Thermal Propulsion Program

Dear Capt. Hartford:

Thank you for providing our office with the draft Environmental Impact Statement (EIS) for the Space Nuclear Thermal Propulsion Program (SNTP). One of the alternative locations for the Particle Bed Reactor component of the SNTP program is the Contained Test Facility (CTF) on the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho. We fully support the proposed adaptive use of the CTF (LOFT) facility. A 13.1

Sections 3.8.2 and 4.8.2 of the draft EIS indicate that the CTF facility is the only property that may be eligible for the National Register of Historic Places within the proposed SNTP project area. Since we feel the CTF facility is eligible for the National Register, we have been consulting with the Department of Energy and EG&G Idaho on the development of an agreement document that stipulates appropriate photographic and historical documentation of the structure. This mitigation is consistent with the measures described in Section 4.8.2.2. 1 9.5

If you have any questions, feel free to contact Suzi Neitzel at 208-334-3847.

Sincerely,

Kenneth J. Swanson
State Historic
Preservation Officer

KJS/wpn
cc: Teresa Perkins, DOE, Idaho Falls
Clayton Marler, EG&G Idaho
Suzanne Miller, EG&G Idaho

The Idaho State Historical Society is an Equal Opportunity Employer

Document 159

30 September 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks Air Force Base, TX 78235-5000

Dear Capt. Hartford:

A 13.1 I was unable to attend the EIS Hearing on 17 September 1992 at the Shilo Inn in Idaho Falls, but I wanted to get my vote in for you folks to move your operation here. The major reason is not the financial benefits that would go along with your program. As an engineer with a highly developed intellectual curiosity and a desire make science fiction science fact, I would love to see what could be developed for the space program, as well as looking at how these developments could be adapted to commerce and industry in the rest of the world. This lab has a well-developed technology transfer program already in place to help speed the adaptation of new methods and technology by outside entities.

I've always thought we were missing the boat on the potential of nuclear energy, and the idea of using less of the highly toxic chemical fuels now so common in the space program appeals to the environmental side of me. I spent part of this spring looking for underground fuel storage tanks at a Marine Air Station in North Carolina, and I understand probably more than most people the potential damage these chemicals could have on eco-systems.

We've got a lab full of people who are qualified and eager to do real science and research. The community of Idaho Falls is poised for growth and could, in my opinion, easily absorb the personnel required for this program. Stationing people here to work on the program would be far less costly than putting them in Las Vegas where the cost of living is so much higher. Our relatively remote location at the site makes finding space to do the actual research a simple task. In short, we're just the best choice for the job. Thanks for taking time out to look at us.

Sincerely,

Margaret E. Galster

Margaret E. Galster
Project Engineer, EG&G ID Inc.

Document 160

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/29/92

A 13.1 I support the Space Nuclear Thermal Propulsion Program at the Idaho National Engineering Laboratory.

Name: Julie Loventhal

Address: 711 Jefferson #2 (Street Address) Pocatello, Id. 83201 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn.: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 161

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-30-92

A 13.1 I support the Space Nuclear Thermal Propulsion Program at the INEL

Name: Rod Nelson

Address: 3374 Charleston (Street Address) Idaho Falls Idaho 83403 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn.: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 162

Greater POCATELLO

September 30, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

With the recent U. S.Air Force's public meetings regarding the environmental impact of the Space Nuclear Thermal Propulsion technology, the Greater Pocatello Chamber of Commerce reiterates its support of continued and expanded environmentally sound operations at the Idaho National Engineering Laboratory.

We recognize that the most recent analyses of exhaust from space nuclear thermal propulsion rockets indicate atmospheric releases per year will be less than 0.4 percent of the annual natural dose received from living in Idaho. We further recognize the SNTP will not affect the quality or quantity of this area's water supply.

Additionally, the Idaho National Engineering laboratory has 40 years experience in nuclear safety testing and maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A 13.1 The Greater Pocatello Chamber of Commerce supports this program and encourages support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

David W. Collins
Executive Vice President

Sincerely,

Edward A. 'Tony' Madsen
Chair, National Issues Committee

427 North Main, Suite A • P.O. Box 626 Pocatello, Idaho 83204 • (208) 233-1525

Document 163

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sept. 08 1992

Dear Sir:

A 13.1 I support the Space Nuclear Thermal Propulsion Program at the INEL

Thank you

Name Clara A. Cook

Address 1202 N 1150 E (Street Address) Shelley Id 83274 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 164

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date 9/08/92

A 13.1 I support the Space Nuclear Thermal propulsion program at the INEL.

Name Don F Cook

Address 1202 N 1150 E (Street Address) Shelley Id 83274 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 165

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/30/92

A 13.1 I support the Space Nuclear Thermal Propulsion Program at the Idaho National Engineering Laboratory

Name [illegible]

Address 3412 E. 166 No. (Street Address) Rigby, Idaho 83442 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 166

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/29/92

A 13.1 I support the Space Nuclear Thermal Propulsion Program at the Idaho National Engineering Laboratory.

Name [illegible]

Address 590 McCormack (Street Address) Pocatello, ID 83201 (City / State / Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 167

David Hensel
P. O. Box 81
Victor, Id. 83455
787-2409

Dear Capt. Hartford,

13.4 A | I am writing to comment on the recent draft for "Space Nuclear Thermal Propulsion Program. I think the new Timberwinds is a bad idea!!

2.1 1 | There is no identified mission for the SNTPP.

6.22 2 | This program will create an enormous amount of radioactive waste: where will the waste be stored? and for how long?

12.71 3 | The last Timberwinds program produced multiple uncontrolled releases of radioactivity into the environment: what safe guards does the public have that this will not happen again?

1.20 4 | The financial costs of this program are huge: what justification is there for the Air Force to be spending defense funds on this type of project? What effect will this program have on other ongoing Air Force Projects. What will be the impact on similar NASA programs?

Thank you,

David Hensel

Document 168

File
15-3-10

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-10-92

1
12.7 | What would the "negligible" effect be on Southern Utah people who have already been bombarded for years with radioactive testing? What will the effect be of the "negligible" amount added to the cumulative amounts we have already received?

The DEIS based the "negligible" amount on people who were at beginning levels of radioactivity. People in Southern Utah have been exposed to "low level radiation" since the early 1950s' above ground testing on through to the "venting" from the underground tests. (over)

Name: Mona Alldredge

Address: 444 S. Main (Street Address) St. George, UT 84770 (City/State/Zip Code)

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 168

Do those in charge not recognize these as the atrocities that they are?
Do you have no conscience?
Where is your morality and humanity that any segment of the population of our great free country is expendible for the "good" of the rest of the country.

13.4 A | Please, choose the alternative of NO ACTION!!

Document 169

File
15-3-10

INEL
Idaho National Engineering Laboratory

October 1, 1992

Captain Scott Hartford
Brooks Air Force Base, TX 78235-5000

Subject: SPACE NUCLEAR THERMAL PROPULSION PROGRAM

Dear Sir:

A
13.1 | I am writing to express my enthusiasm and support for the Space Nuclear Thermal Propulsion System. I was raised here in Idaho Falls and would be proud to know that our region was taking the lead in the development of such an exciting concept. Please consider the INEL as the ideal location for the SNTP test facility. The greater community is very supportive of the INEL and all it is doing. Thank you.

Sincerely,

Robert A. Crane

EG&G Idaho, Inc. P.O. Box 1625 Idaho Falls, ID 83415

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[illegible] Governor

STATE OF NEVADA

[illegible] Executive Director

AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE
Capitol Complex
Carson City, Nevada 89710
Telephone: (702) [illegible]
Fax: (702) [illegible]

October 5, 1992

Captain Scott Hartford
United States Air Force
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Re: Comments on the Draft Environmental Impact Statement for the proposed Space Nuclear Thermal Propulsion program (DEIS SNTP)

Dear Captain Hartford:

Thank you for providing the Nevada Agency for Nuclear Projects with the above mentioned Draft Environmental Impact Statement (DEIS). Our comments include a re-cap of the testing program and a discussion of general concerns. We conclude our comments with a list of specific recommendations.

PROGRAM RE-CAP:

The Space Nuclear Thermal Propulsion (SNTP) program could be characterized as a step-by-step research effort designed to produce a full-scale nuclear rocket propulsion system. According to the Air Force, the system would weigh less than conventional chemical systems while generating twice the lift. As proposed, the system would be deployed in the outer atmosphere for second stage propulsion.

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According to the DEIS, the rocket engine would be designed to heat propellant (liquid hydrogen) to high temperatures. The propellant would pass through a nuclear reactor, expand, and then be exhausted to produce thrust. During ground testing, the hydrogen would be exhausted through a filter system to capture reactor fission products and then flared to the atmosphere. Hydrogen flares would reach 540 degrees(C) and travel several hundred feet into the atmosphere.

The primary technology to be tested is the Particle Bed (Nuclear) Reactor (PBR). Overall program activities would include the design, fabrication, testing, and analysis of both nuclear and non-nuclear components, including nuclear fuel elements and reactor assemblies. The program also proposes the construction and operation of a validation ground test facility. The ground facility would be used for a series of tests including final ground qualification of the completed nuclear rocket system.

We understand that a decision to initiate the SNTP program does not constitute a decision to execute actual rocket flight or otherwise deploy the PBR technology. And, as indicated in the DEIS, the decisions to be made are limited to:

1. Whether to continue the SNTP program through the development of nuclear thermal propulsion technology,

2. Whether to construct and operate a PBR validation test facility, and

3. Where to locate the PBR validation ground test facility if the program is to continue.

GENERAL CONCERNS

(1) Need for the Proposed Action:

1 In general, we found the DEIS fails to adequately discuss or
2.1 justify the development and testing of the nuclear rocket program. The document is vague: Why is the technology being

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1 developed? Who would it benefit? Despite broad statements
cont'd supporting the technology could be applied to future advanced upper stage rocket engines and orbital transfer vehicles, and Air Force mission requirements, the DEIS fails to justify the need for the proposed action. The DEIS does suggest the technology
2.1 could be used by the Air Force to increase global military power, reduce the cost of military operations, and decrease the logistical aspects of maintaining military forces. However, nowhere in the document are any of these ambiguous mission requirements explained or justified.

It is worth mentioning that in news releases and technical papers forwarded to the State of Nevada as scoping material for the DEIS, we found several references suggesting that the National Aeronautics and Space Administration (NASA) would be the primary user of the envisioned nuclear rocket propulsion technology. And yet an alliance with NASA is not developed in the DEIS leaving the reader only to conclude the technology will be used for military purposes (presumably SDI) and not for space exploration.

In the State of Nevada's scoping comments submitted for the program, we said that "since the SNTP program has been
2 declassified, we would expect the forthcoming draft Environmental
2.2 Impact Statement (EIS) to disclose the intended use of the technology in terms of civilian and military applications." We
3 also said that "if the program is envisioned to support the Bush Administration's Space Exploration Initiative', then the Draft
1.20 EIS should explain the role NASA will have in both developing and deploying PBR propulsion technology." The DEIS fails, however, to address these concerns.

(2) Alternative Site Analysis:

4 The DEIS does not specify a preferred alternative for locating the ground test facility. The document simply states
3.3 that either the Saddle Mountain Test Station (SMTS)[2] in Nevada or the Contained Test Facility (CTF)[3] in Idaho could serve as the ground test facility.

3

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It's important to mention, however, in an earlier classified final EIS for the SNTP program, the SMTS site in Nevada was selected as the preferred alternative for locating the ground test station. This classified final EIS was subsequently declassified and shelved. Nevertheless, the reasons provided in this earlier document for selecting Nevada as the location for ground testing were based on the site's ability to provide a better security profile along with the notion that event related tests are common at the Nevada Test Site (NTS) and "do not draw public attention . . ." It is common knowledge, however, that nuclear testing in Nevada continues to generate large anti-testing demonstrations.

The current DEIS makes the finding that no significant environmental impacts can be expected from construction or operation of a ground test facility at either of the proposed sites (see DEIS table 2-1). We contend, however, that the DEIS fails to provide the type of information needed to support an informed siting decision.

(3) Land Use Conflicts:

5 Although the DEIS provides a general discussion of land use and infrastructure within a 50-mile radius of the SMTS site in Nevada, the document fails to fully assess the potential institutional conflicts arising out of future land use activities in the area. Principally, the discussion of the high-level waste repository program being conducted by DOE's Office of Civilian Radioactive Waste Management (OCRWM) at Yucca Mountain Nevada is
5.2 both shortsighted and inconclusive. Yucca Mountain is the only site in the nation being studied for the disposal of civilian reactor fuel and high-level defense waste. Yucca Mountain is located only 19 miles (SW) from the proposed SMTS site. Repository siting guidelines (10 CFR part 960) stipulate that military installations and operation, including atomic energy defense activities (such as the nuclear rocket program), may not significantly affect repository siting activities. The guidelines further require that the quality of the environment be adequately protected during repository siting.

4

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5 cont'd | Access to the SNTP site passes directly through NTS Area 25. Area 25 contains the project support facilities and is the location of site investigation field studies at Yucca Mountain.
5.2 | Potential long-term institutional conflicts between the two programs include security and scheduling problems and the potential for increased risk of radiological exposure to OCRWM personnel and contractors.[4]

6 | Likewise, the discussion of potential conflicts between the proposed ground testing facilities at NTS and DOE's Environmental Restoration and Waste Management program (ERWM) were also not
5.1 | fully assessed in the document. Planned ERWM activities at NTS include the preparation of a site-wide EIS. This EIS will assess the long-term impact of environmental restoration, waste management, and decontamination and decommissioning activities for all programs at the site. In addition, DOE/NV has proposed
7 | NTS as a regional treatment, storage, and disposal site for
6.19 | transuranic (TRU), low-level, and low-level mixed radioactive waste.[5] These plans, along with the possibility of a moratorium
8 | on nuclear testing, have already altered historic land use activities at the site. And yet the DEIS fails to either
5.1 | acknowledge or address how the SNTP program would conflict with these changing mission requirements.

(4) Socioeconomic Impact:

As indicated in the DEIS, the SNTP program would not generate any significant socioeconomic impacts in Nevada. We note construction of the ground test facility would take between 18 and 24 months, employing a peak work force of only 100 workers (about 2 percent of the NTS labor force). To operate the facility, only 50 to 60 technical, security, and administrative personnel would be needed over the 10 year duration of the project.

While the employment numbers to support ground testing are insignificant in terms of economic benefit to Nevada, the project as a whole will likely generate significant activity for several U.S firms and government entities. Although the DEIS avoids disclosing the total economic contribution (program cost) that would be generated from materials and component development, the declassified EIS (mentioned above) listed eight major

5

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facilities[6] in six states that would produce materials for the program. Moreover, the U.S. House of Representatives (102nd Congress) recently proposed a $100 million appropriation for the program. None of these facts, however, are disclosed in the DEIS.

(5) Background Radiation:

Over 700 reported nuclear tests have been conducted at the Nevada Test Site (NTS), 100 of which were above ground atmospheric tests. Nuclear testing has left varying amounts of long-lived fission products in the soils, rock, and ground water. In all, DOE has identified 700 separate contamination sites on NTS. Contamination includes surface and subsurface radionuclides, buried mixed waste, organic compounds and heavy metals. Portions of the waste have been disposed of in radioactive waste management areas, landfills, leachfields, and injected into underground wells. An estimated 11,000 acres of soil on the site is contaminated to shallow depth with plutonium
9 | and uranium. Re-suspension of these materials may pose
12.59 | significant radiological hazards.

As mentioned above, Area 25, the site of the Yucca Mountain field office, is only 19 miles from the proposed SNTP ground test facility and was the site of the original nuclear rocket program. Area 25 contains several contamination zones including an abandoned sewage treatment plant, several inactive storage tanks, leachfields, and contaminated waste disposal sites. The leachfields, storage tanks, and waste disposal sites may have received radioactive wastes and mixed wastes from the original rocket testing program.

10 | In determining the background radiation for NTS, past nuclear research and testing activities were not considered in
12.57 | the DEIS. Background calculations presented in the document were strictly limited to usual exposure mediums, such as cosmic radiation, terrestrial radioactive materials, X-rays, air travel, "global" nuclear weapons fallout, and exposure to radon gas --
11 | based on an average national annual rate. The DEIS fails to
12.58 | consider other available data from ongoing radiation monitoring programs at NTS.

6

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Accordingly, it would seem that historical testing activities, including the potential for re-suspension of plutonium, and tritium left from the weapons effects and rocket testing programs, could significantly increase the site's background radiation level above what would originally be determined from natural causes.

(6) Radioactive Waste:

The discussion of radioactive waste treatment, storage, and disposal is incomplete and misleading. The document states that approximately 1.6 million cubic feet of low-level radioactive waste would be generated over the life of the SNTP project. This radioactive waste would be created from handling, cleaning, and disassembling canisters; from Effluent Treatment System (ETS)[7] contamination removal; and from the decontamination of the facility itself.

The DEIS further states that all low-level waste would be disposed of at the NTS Area 5 Radioactive Waste Management Site (RWMS). The volume of low-level waste generated by ground
12 | testing would add 10 percent to the annual amount of low-level waste disposed of at the NTS RWMS. It is unclear, however,
6.18 | whether this amount was determined on the basis of existing on-site waste generation and disposal, or on the basis of future waste shipments from offsite DOE facilities. As mentioned previously, DOE/HQ is preparing a Programmatic EIS for the agency's Environmental Restoration and Waste Management program. The Implementation Plan for that document states that NTS will be considered as a regional disposal site for low-level radioactive
13 | waste. Hence, any cumulative forecasts of low-level waste
6.19 | disposal at NTS must account for increased waste disposal from future off-site shipments.

The DEIS proposes the use of an ETS (Effluent Treatment System) to capture fission materials released from the reactor
14 | through the rocket engine exhaust. The document fails to disclose whether liquid radioactive waste would be contained in the ETS. We can only assume that the Air Force and DOE are aware
6.20 | that liquid radioactive waste cannot be stored or disposed of at NTS. If any liquid radioactive waste is generated, alternative treatment technologies must be considered.

7

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15 | In the classified final EIS (mentioned above) there is a statement that says "the only material anticipated to be generated . . . that would be certified as High-Level Waste (HLW) would be in form of spent reactor fuel." Although final EIS acknowledges that HLW would be generated, the present DEIS states that only TRU waste would be produced?

Also, no where in the DEIS is there a definitive description about the disposition of the irradiated fuel elements (presumably HLW) that would be produced from test operations. The DEIS does state that once each PBR propulsion reactor core (containing the irradiated fuel) reaches total source term, it would be taken
6.1 | "out of service." And yet the discussion about final disposition of the reactor cores is limited to several unsubstantiated and muddled alternatives (see sections 4.12.2.4 and section 3.2.1, Appendix E). For example, statements are made in the DEIS suggesting the irradiated fuel might be shipped back to Lynchburg Virginia for analysis, or shipped to some offsite hot-cell facility. Other alternatives include shipping the fuel to an undisclosed processing facility to recover highly-enriched uranium, or treating the fuel as waste for either on-site or off-site disposal, depending on a given site's "waste acceptance criteria." Beyond these brief statements the DEIS fails to provide specific solutions for the disposition of *irradiated* reactor fuel.

(7) Radiological Hazards:

According to DEIS, normal operations of the ground testing facility will entail the release of small quantities of radioactive materials (primarily noble gases, halogens, volatile elements and some particulates) to the atmosphere. The design
16 | criteria for normal operations of the test facility specifies an annual radiation exposure of no more than 20 percent of the EPA standard. (The standard limits radiation exposure to 10 millirem
12.72 | per year to any one individual -- 40 CFR Part 61, Subpart H.) It should be noted, however, that a plausible accident scenario described in the DEIS (Consequence IX) would expose the population in southern Nevada to a radiation dose of 23.5
17 | millirem or twice the EPA standard. Furthermore, a worst case accident scenario involving a test facility accident would
12.73 | subject workers at Yucca Mountain (Area 25) and at Mercury (Area 23) to an estimated peak acute dose of up to 300 millirem.

8

(d) Safety Analysis:

To protect humans and the environment from accidental radiological releases, the ground testing program would be subject to DOE's Safety Analysis Reporting process. This process requires preparation of several preliminary and final safety analysis reports (SARs). Individual SARs would be written for each test series leading to the final qualification of the nuclear rocket engine.

As indicated in the DEIS, the safety analysis process will dictate configuration of the ground test facility including final design of the PBR. The SAR process will also assure conformance to DOE orders, trigger document compliance with the National Environmental Policy Act, as well as provide a detailed accident analysis for each major test series.

Although we support the concept of incremental testing and development, we are not convinced that DOE's SAR process will encourage optimum decision making to safeguard public health and safety. As might be expected, DOE's environmental record has left Nevadans skeptical about hosting another nuclear testing program based on DOE safety policies. Thus, leaving these safety policies in the hands of DOE decision makers, without any public and state oversight, may not be appropriate.

RECOMMENDATIONS:

Since a clearly demonstrated need for the proposed action was not presented, explained, or clarified in the DEIS, we must recommend that the No Action Alternative be implemented. This means that development and testing of nuclear thermal propulsion technology should be discontinued until a specified purpose and mission for the program is identified. Further, if the Air Force and DOE continue to assert that the proposed SNTP program must be implemented, then we insist that this DEIS be withdrawn and a new DEIS be prepared that rectifies the following shortcomings in the current draft.

18 • The DEIS fails to clearly identify and discuss all essential
factors needed for making an informed siting decisions for the
1.22 ground test facility. Regulations published by the Council on
Environmental Quality (40 CFR 1502.29(b)) require federal
agencies to discuss these essential factors.

19 • The cumulative institutional and environmental impacts that
6.19 would be created by the SNTP program, in terms of expanded
treatment, storage, and disposal of radioactive waste, were not
fully assessed in the DEIS.

20 • The residual radiological effects caused from nuclear testing,
research, and development at the Nevada Test Site were not
12.59 considered in calculating the natural background radiation level
for NTS proper as well as NTS Areas 14, 25, and 23 respectively.

21 • The DEIS failed to provide a specific and definitive
description of the disposition of all irradiated fuel that would
be left after test operations. It should be noted that if these
6.1 fuel elements constitute high-level radioactive waste, they
cannot be stored in Nevada. Nevada Revised Statute (NRS 459)
prohibits any person or governmental entity from storing high-
level radioactive waste within the State.

22 • The amount of radiation (caused from an accidental release)
7.2 would not meet the annual EPA exposure standard set forth under
the Clean Air Act, Title 40 CFR Part 61, Subpart H. The DEIS
failed to clarify this issue.

23 • Finally, the DEIS fails to address the need for a public
review and state oversight program as part of DOE's Safety
12.74 Analysis Reporting process. Questions about the need for public
review and state oversight were raised in the State's scoping
comments.

Again, thank you for providing the Nevada Agency for Nuclear Projects an opportunity to comment on the Draft Environmental Impact Statement for the proposed Space Nuclear Thermal Propulsion program. Based on our evaluation, we have concluded that developing and testing nuclear propulsion technology must be discontinued until a specific application for the technology has been clearly established. We also maintain that the DEIS fails to address several critical issues that must be considered (assuming the program moves forward) in a revised DEIS.

Sincerely,

Robert R. Loux
Executive Director

RL/jbw
cc: Governor Bob Miller
Nevada Congressional Delegation
State Clearinghouse
Gary D. Vest, USAF
Lt. Col. Gary Baumgartel, USAF
Joseph H. Fiore, DOE/NV

ENDNOTES

1. On the 20th anniversary of Apollo 11 (first moon landing), President George Bush announced a new vision for America in the 21 century. The vision was to return to the moon and then onward to Mars. This vision called the Space Exploration Initiative would put a man on Mars by 2019.

2. The SMTS in Nevada is located on the Nevada Test Site in Area 14. Area 14 is about 75 miles northwest of Las Vegas. Las Vegas supports a residential population of more than 800,000 residents along with hosting more than 20 million tourists annually. Las Vegas is within the Region of Influence that could be affected by the SMTS facility. The DEIS defines the Region of Influence as the geographical region that would be affected in some way (e.g. radiological exposure) by the proposed action.

3. The Contained Test Facility (CTF) in Idaho is located on DOE's Idaho National Engineering Laboratory (INEL) in south central Idaho. The estimated population within CTF's region of influence is 146,000 residents.

4. As indicated on page 3-80 in the DEIS, predominant winds at the SMTS site flow northwesterly during the winter months. Yucca Mountain is located north and west of the SMTS, meaning that any emissions of radionuclides to the atmosphere from rocket testing during the winter months would flow directly toward Yucca Mountain.

5. See Draft Implementation Plan for the Programmatic Environmental Impact Statement for the Department of Energy Environmental Restoration and Waste Management Program, January 1993.

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6. Facilities mentioned in the de-classified EIS that would be involved in materials and component development for the SNTP program include: The Brookhaven National Laboratory and Grumman Space Electronic Division of New York; the Babcock and Wilcox Company of Virginia; Sandia National Laboratories of New Mexico; Allied-Signal Aerospace and Garrett Fluid Systems Division, Arizona; Aerojet Propulsion of Sacramento, California; and the Hercules Aerospace Corporation of Utah.

7. The EES system would be designed to retain 99.9 percent of the fission products expelled from the reactor through the rocket assembly. Although the EES system has yet to be designed, it would function as the principle safety barrier to prevent the release of radionuclides to the environment.

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State of Idaho
DEPARTMENT OF HEALTH AND WELFARE
INEL Oversight Program • 800/232 INEL

1410 N. Hilton • Boise, Idaho 83706
1920 E. 17th • Idaho Falls, Idaho 83401

CECIL D. ANDRUS
Governor
RICHARD P. DONOVAN
Director
Dept. of Health and Welfare
DAVID L. HUMPHREY
Oversight Coordinator
STEVE R. HILL
Administrator

October 5, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks Air Force Base, Texas 78235-5000

Dear Capt. Hartford:

The state of Idaho, through the INEL Oversight Program, submits the following comments on the Space Nuclear Thermal Propulsion (SNTP) program draft Environmental Impact Statement prepared jointly by the U.S. Air Force and the Department of Energy.

The Air Force presented this project as developing new technologies at INEL creating jobs in Idaho and generating low volumes of waste. The balance between jobs and waste produced is much closer than initially indicated at meetings with state officials.

The expected employment at INEL would be 100 construction jobs during the peak season. On-site personnel associated with this project would be approximately forty, none of which are involved in the research and development of the project. Contrast this benefit to the expected wastes. For example, low-level waste generation from operation and decommissioning efforts is estimated at 1.6 million cubic feet. This is a significant increase in waste generation regardless of which volume cite in the Draft Environmental Impact Statement (DEIS) is chosen for comparison. Further, the research and design efforts for this project are being carried out at other national laboratories instead of INEL. The project is not technology development; rather it is a demonstration project for a technology dating from the Aircraft Nuclear Propulsion days.

CHAPTER 1

PURPOSE AND NEED

1 Air Force regulations adopt the Counsel on Environmental Quality (CEQ)
2.1 regulations to be read together with 32 CFR Part 989. 32 CFR § 989.1. The CEQ requires agencies to include a purpose and need statement in each environmental impact

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Page 2

1 cont'd statement (EIS). 40 CFR § 1502.10. The SNTP EIS provides a summary paragraph of the need for the Air Force's revitalized project. The PBR [particle bed reactor] propulsion technology finds its need in "broad mission applicability." SNTP Draft EIS (DEIS) 1-3. A final classified EIS released in September 1991 contains a more abbreviated description of the need. That proposal blacked out the needs statement in the unclassified version. Final EIS (FEIS) 1.1-2. This does not meet the NEPA requirements.

2.1 The purpose of the project is as mysterious as the original FEIS authoring agency's identity. The EIS describes the Air Force's mission to investigate new promising technologies. However, the purpose for this technology is not explained. References to defense applications are made and potential application to National Aeronautic and Space Administration (NASA) projects is deduced from NASA's participation in the FEIS. Specific uses are not outlined, alluded to or discussed.

SCOPE OF EIS

2 An environmental impact statement must consider cumulative and connected actions. The last assessment of INEL activities cumulative impacts on the environment was the 1977 EIS prepared by the Energy Research and Development Administration.
1.1 This document was not cited as a reference in the DEIS. The mission of and projects at INEL have changed dramatically from those discussed in the 1977 EIS. See generally, INEL Site Specific Plan for fiscal year 1993. This is yet another project in a list of proposals for INEL that seeks to proceed without adequate evaluation of current environmental baselines.

3 The DEIS does not address the connected actions associated with the SNTP, a possible result of the vague purpose statement. This EIS covers ground testing of the SNTP. Validation needs for future nuclear thermal propulsion technologies, proposed to
1.2 be accommodated by the selected facility, will require additional NEPA documentation. SNTP DEIS 1-4. These future actions, e.g. flight tests, are closely related, interdependent parts of the SNTP project which should be included in the Final EIS.

CHAPTER 2: ALTERNATIVES

4 Multiple tests for the Ground Test Articles will have an effect on the integrity of the
12.36 fuel. Further, the fuel composition fails to consider the wide range of fission release
5 fractions. This calls into question the fuel's integrity, and the quality control for fuel
3.10 manufacturing must be made available for inspection.

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Capt. Scott Hartford
October 5, 1992
Page 3

6 Regardless of final site selection, this fuel will be transported from Babcock & Wilcox in Lynchburg, Virginia. This transportation, and any on-site transportation, must
6.15 be analyzed. This includes a RADTRAN analysis of transportation risk and safety analysis of the transporting casks.

CHAPTER 3: AFFECTED ENVIRONMENT

The DEIS inaccurately describes current management practices at INEL. Specific examples include:

HAZARDOUS WASTE MANAGEMENT

7 The 880 cubic feet annual amount of generated wastes cannot be verified. The Hazardous Waste Shipping Facility, aka Hazardous Waste Storage Facility, provides waste generation in cubic feet. Information provided to the state by DOE-ID describes
6.23 generation rates in pounds. The DOE, as a support agency, should insure consistent information is provided in environmental documents. Additionally, existing capacity cited in the DEIS (8800 cubic feet) exceeds the design-capability listed in the RCRA Part B permit (3800 cubic feet).

SOLID LOW LEVEL WASTE (LLW) MANAGEMENT

8 The DEIS presents conflicting amounts of LLW disposed of annually. In the Affected Environment chapter, the amount is 11 million cubic feet. DEIS 3-17. In the
6.24 Environmental Consequences chapter, the amount is 102,000 cubic feet. DEIS 4-10. The Activity Data Sheets prepared by DOE-ID and submitted for fiscal year 1993 estimates 80 to 100 cubic feet of LLW is currently disposed of annually. The correct value must be
9 presented in the Final EIS. Additionally, personnel resources and physical capacity will be affected by the decommissioning efforts at other INEL facilities and ongoing
6.25 environmental restoration projects. Have these contributors been included in the SNTP DEIS capacity analysis?

MIXED WASTE

10 Mixed waste is not currently shipped off-site to a RCRA permitted Treatment, Storage or Disposal (TSD) facility because a TSD is unavailable. The Air Force should
6.5 describe the interim management techniques applicable to the SNTP mixed waste.

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11 6.28 Additionally, the FEIS must identify the volume of LDR wastes expected to be generated (mixed or hazardous) and the available treatment technologies.

Geology and Soil

12 10.6 The likelihood of a sizeable earthquake in the foreseeable future may in fact be significant as opposed to extremely slight. SNTP DEIS 3-40. DOE initiated probabilistic and deterministic seismic risk assessments for the INEL as part of the NPR site-suitability review process. These risk assessments should be applied to the SNTP and completed with full disclosure of data, assumptions and models used to determine seismic risk at SNTP candidate sites on the INEL.

13 10.1 Defining an aseismic zone in eastern Idaho, southwest Montana and northwest Wyoming in which the INEL resides is now questionable because of these studies and recent earthquake activity in this zone.

Water Resources

14 11.3 In addition to the cited sources of recharge of the Snake River Aquifer, contributions from percolation ponds should also be considered. The percolation ponds are major recharge sources during droughts. Water quality discussions must include chemistry of waste waters, management techniques beyond storage and all regulatory requirements.

15 11.4 The DEIS misleadingly characterizes the state of ground water quality. The water quality section states the ground water quality meets drinking water standards in the vicinity of INEL. SNTP DEIS 3-47. While no drinking water wells currently exceed drinking water standards, this statement ignores the individual areas known to be above regulatory standards.

Chapter 4: Environmental Consequences

16 1.1 Without a current site-wide assessment of the environmental impacts of INEL operations, the SNTP DEIS cannot conclude actions will not contribute to potential cumulative impacts. SNTP DEIS 4-1.

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October 5, 1992
Page 5

Mitigation Efforts

One important ingredient of an EIS is the discussion of steps that can be taken to mitigate adverse environmental consequences. Implicit in NEPA's demand for a detailed statement is the understanding that the EIS will discuss the extent to which adverse effects can be avoided. Without this discussion, neither the agency nor other interested groups can properly evaluate the severity of the adverse effects. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332 (1989). Mitigation measures must cover the range of impacts of the proposal. CEQ guidance Question 19a, 46 FR 18032. CEQ specifically includes design alternatives and land use controls as examples. Even measures unlikely to be adopted should be presented. *Ibid.*

17 6.3 The SNTP EIS must fully discuss the mitigation efforts beyond an assertion that existing waste reduction methods will be used. For example, nonradioactive hazardous waste will implement a "minimization program to limit the generation of nonradioactive hazardous waste (solvents)." SNTP DEIS 4-8. Stronger commitment to and additional discussion of mitigation measures must be included in the Final EIS. For example, the Pollution Prevention Unit of EG&G Idaho administered under the Planning and Development section should be included in the facility design and operating procedures from the start. This unit could provide specific techniques to reduce waste generation. A similar effect could be achieved in the solid LLW. Instead of expanding the RWMC, directly conflicts with the INEL's goal of a 75% reduction in LLW (based upon 1990 volumes) by 2000, the SNTP program could reduce LLW generation. See ADS 1314-89. Overall, the mitigation measures are noncommittal and nondescript.

Seismic and Volcanic Activity

18 10.6 The published DEIS limits the seismic discussion to "[d]ue to the seismic character of the CTF area, no impacts related to earthquakes are expected." SNTP DEIS 4-21. As stated earlier, seismic concerns are realistic and should be addressed rather than dismissed. Seismic studies conducted as part of the NPR project should be reviewed and completed by the SNTP project. Information has been forwarded to peer review groups. However, no conclusions are available. The SNTP should complete these reviews and publish the data for external review. Once information is released, the seismic character of the CTF area can be fully explored. The FEIS at least raised the issue of seismic activity. FEIS 3.2-43. Its conclusions are called into question by the NPR DEIS.

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Capt. Scott Hartford
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Water Resources

19 11.5 Current understanding of ground water systems in the TAN area is incomplete. This holds true especially with regard to magnitude and distribution of transmissivity, vertical variations in permeability and drawdowns and the effect these have upon the flow system and contamination plumes. The potential effects may be seen in the TAN injection well contamination being drawn upgradient by production wells at the TAN Support Facility. The SNTP requires a small amount of the total INEL water rights available. However, the effects of two million gallons for construction and three million gallons per operating year on the TAN ground water remediation must be considered and disclosed in the FEIS.

Health and Safety

20 12.62 The SNTP predicts 20% of the NESHAPs standard for radionuclides. While this increase will not exceed the 10 mrem standard, it does represent a significant increase in the site's current radionuclide release.

21 12.63 For accident calculations, the Air Force postulates a SITA Consequence I would produce 880 mrem at 120 km. This number is not included in any tables explaining dose calculations nor is it distinguished by type of accident or exposed individuals.

22 12.64 The DEIS states the dose from this project decreases with distance. However, the statement is not supported. Time and distance data are necessary and should be presented in the DEIS. This would affect response times and geographic distribution of the dose. The graphs presented in the classified version should be reinstated and expanded.

Appendix E

23 12.65 The DEIS establishes a go/no-go decision point at 170 mrem in any uncontrolled area. The Air Force does not define uncontrolled area. This could be grazing areas, office buildings on-site, or off-site areas. No explanation for choosing 170 mrem is given.

Meteorology

24 12.66 The DEIS selects low ceilings for accident scenarios. This represents conservative estimates for accidents. However, a hydrogen explosion is treated as an individual

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Capt. Scott Hartford
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24 cont'd 12.66 phenomenon in later sections. Instead of remaining within the bounding areas, a hydrogen scenario would produce a fuel product at 3.2 km high. This scenario should be considered in the radiation impacts for dispersion.

25 12.67 *The DEIS* presents radiological releases from operations based upon 5 test operations. In fact, a correct estimate is 120 operations over the project's lifetime. The Air Force should present a complete picture for assessment.

Source Term Development

26 12.68 The fission inventory presented in Tables E-3 and E-4 lists the total radiologic inventory expected from the project. The total fission products released during operating scenarios are presented in Table E-6. This table contains selected radionuclides with short half-lives. No explanation is given for excluding a majority of the inventory of Tables E-3 and E-4. Because Table E-6 establishes the source term, an incorrect evaluation will affect the dose models presented in the DEIS. Additionally, if a physical fracture occurs, radionuclides included in the fission inventory should be present in an accident scenario. For example, cesium and strontium are not listed in Table E-6, but would be expected in a highly mobile event.

Population Site-Specific Data

27 12.69 The MACCS Polar Grid assumes equal population distribution throughout the grid. This is an inappropriate assumption based upon actual population patterns. Site-specific data should be used in this model. The DEIS used 1980 census data for parts of the model. Census data from 1990 is available and should be substituted. These inaccuracies could affect the person-rem dose. Figure E-1 includes shaded areas not defined and is not explained.

Impact Analysis

28 12.70 Table E-13 presents data based on cumulative maximum exposed individual doses. This data should be compared to a MESOCIF analysis to assure underlying assumptions are accurate.

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Capt. Scott Hartford
October 8, 1992
Page 6

CONCLUSION

This DEIS raises more questions than it answers. Based upon the information presented, it is questionable whether the Air Force has adequately considered existing site activities and environments, current waste management capabilities and the underlying need for this project. In an era of scaled-back defense production at DOE facilities, the need for this project remains [illegible]. The discrepancies presented in these comments should at the least lead to a revised EIS.

Sincerely,

Steve R. Hill
Administrator

SRH/TAH/[illegible]

[illegible]

Document 172

Please mail this form to:

AFCEE/ESEP
Attn: Capt. Scott Hartford
Building 1155
Brooks Air Force Base, TX 78235-5000

PUBLIC HEARING WRITTEN COMMENT SHEET

Space Nuclear Thermal Propulsion (SNTP) Program

I was unable to attend the public hearing on the SNTP Program held September 8, 1992, in Las Vegas, Nevada. However, my comments on the draft environmental impact statement, and on the program in general, are as follows:

Date: SEPT 3-92

A
I FULLY SUPPORT THE SNTP EFFORT AND
13.3 BELIEVE THAT IT WILL HAVE NO ADVERSE
EFFECTS ON THE ENVIRONMENT. OUR SPACE
PROGRAM SORELY NEEDS THIS TECHNOLOGY FOR
CONTINUED ACTIVE EXPLORATION OF SPACE.
I WAS AND STILL AM INVOLVED IN ROCKET
BUSINESS OF RADIATION + THERMAL EFFECTS ON
THE ENVIRONMENT AND MADE MANY FIRINGS
DURING THE ROVER PROGRAM OF THE 60'S SO
I KNOW WHEREOF I SPEAK.
GOOD LUCK!

Name: [illegible] R. CLELAND
Address: [illegible] LAS VEGAS NV 89129
Company/Organization Represented: EG&G / [illegible]

Document 173

Five County Association of Governments

[illegible]
St. George, Utah 84770
[illegible]

SOUTHWESTERN UTAH

Post Office Box [illegible]
St. George, Utah 84771
[illegible]

September 16, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

I attended the public hearing regarding the SNTP on September 10, 1992, in St. George, Utah. At that time, I noted that only one of five county commissions had received notification of the SNTP EIS process. As you requested, enclosed is a list of commissioners' names and addresses.

I would also like to take this opportunity to add one additional suggestion regarding the final EIS document. Based upon the

1
12.31 concerns at the St. George meeting, I would suggest that an additional section be added to the EIS which compares the potential releases of radiation from the SNTP Project to releases noted in tests of nuclear submarine or carrier reactor tests, medical equipment using radiation, and the releases from other tests at the two proposed sites.

2
12.32 I feel that this type of comparison will help bring the issue into perspective. Another comparison could be made between the pollutants emitted by conventional liquid or solid rocket propellants as opposed to the SNTP.

Thank you for the opportunity to participate in the EIS process.

Sincerely,

Kenneth L. Sizemore, Director
Community and Economic Development

KLS:[illegible]
Enclosure

Document 173

2/92

FIVE COUNTY REGIONAL COMMISSION LIST

BEAVER COUNTY

Commissioner Gary E. Sullivan
Chairman, Beaver Co. Commission
372 South 400 West
Milford, Utah 84751
PHONE: 387-5544 (hm)

Commissioner [illegible] Marshall
Beaver County Commission
P.O. Box 247
Minersville, Utah 84752
PHONE: 386-2300 (hm)

Commissioner Chad W. Johnson
Beaver County Commission
140 West 100 North
Beaver, Utah 84713
PHONE: 438-2812 (wk)
438-2896 (hm)

IRON COUNTY

Commissioner Roy P. Urie
Chairman, Iron County Commission
396 [illegible] Avenue
Cedar City, Utah 84720
PHONE: 586-9782 (hm)

Commissioner Robert L. Gardner
Iron County Commission
477 Ridge Road
Cedar City, Utah 84720
PHONE: 586-8718 (hm)

Commissioner James C. Robinson
Iron County Commission
P.O. Box 686
Parowan, Utah 84761
PHONE: 477-3479 (hm)
586-7752 (wk)

GARFIELD

Commissioner Thomas V. Hatch
Chairman, Garfield Co. Commission
70 North 400 East
Panguitch, Utah 84759
PHONE: 676-2214 (hm)
676-8[illegible] (wk)

WASHINGTON COUNTY

Commissioner Jerry B. Lewis
Chairman, Washington Co. Comm.
110 East 600 South
St. George, Utah 84770
PHONE: 673-5317 (wk)
673-3306 (hm)

Commissioner Scott Hirschi
Washington County Commission
339 South 640 East Circle
St. George, Utah 84770
PHONE: 673-6422 (hm)

Commissioner Gayle M. Aldred
Washington County Commission
197 East Tabernacle
St. George, Utah 84770
PHONE: 628-9307(wk)

KANE COUNTY

Commissioner C. Glen Martin
Chairman, Kane Co. Commission
110 East End Shadow Lane
Kanab, Utah 84741
PHONE: 644-5726 (hm)
644-2006 (wk)

Commissioner Jack Maxwell
Kane County Commission
Glendale, Utah 84729
PHONE: 644-2364 (hm)

Commissioner Raymond R. Lopeman
Kane County Commission
250 North 100 West
Kanab, Utah 84741
PHONE: 644-5337 (hm)

GARFIELD

Commissioner Louise Liston
Garfield County Commission
P.O. Box 213
Escalante, Utah 84726
PHONE: 826-4363 (hm)

Commissioner Sherrell Ott
Garfield County Commission
P.O. Box 31
Tropic, Utah 84776
PHONE: 679-8662 (hm)

Document 174

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Aug 14 1992

Greetings! After observing all the speakers at Thursday night's meeting (St. George, Utah. Holiday Inn), I'm glad I didn't get a chance to speak! I do wish to respond to the racism in those parents, and their slurs! I watched your performances during the whole [illegible] as you were verbally [illegible] [illegible] always [illegible] that if one wishes to be heard, racism has no place.
1 My issue is with the cultural resources! In your Draft
E.I.S., no one addressed the Native American's point-of-
9.3 view! Is there a possibility for the Native Americans to [illegible] with you, or your consultants, in the near future? In closing, all of you did your uniform proud! Thank you! I am, [illegible]

Name [illegible]

Address P.O. Box [illegible] Ivins Utah 84738

Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 175

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sep. 21 '92

A Capt. Scott Hartford
Dear Sir, I am against
13.4 any more bombs set off at test range that come up over Utah in this [illegible]

Thank you

Name Ivan H. Hunt

Address 372 N. Main Gunlock Utah 84733

Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 176

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

A
13.4 WE DO NOT WANT THE PROGRAM! Date: Sep 12 '92

I very much object to officials coming to give us information about a life-threatening project to us when they are not the officials who will make the final decisions. The project is a waste of money that should be used to help people get education, jobs and homes and help with an avalanche of social problems in these uncertain times.

I am appalled at the waste of money so far. An [illegible] technical book delivered by Federal Express with [illegible] part in collecting the data.

The meeting was so technical and so boring and the displays so hard to read and understand a great number of people left.

Name Mrs. Kae Whitwood

Address [illegible] N. 300 E. Washington, Utah 84780

Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 177

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: Sept 21-92

Captain Scott Hartford
Dear Sir
A I very much oppose this proposition
13.4 of sending anymore bombs over Utah.
I am a victim of this & have suffered a great deal.
[illegible]

Jessie W. Hunt
Gunlock Utah
84733

Name Jessie Waite Hunt

Address 372 N. Main Utah 84733

Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 178

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-15-92

A 13.4 I AM COMPLETELY OPPOSED TO THE SNTP. NOT ONLY DO I FIND THE PROJECT ITSELF DANGEROUS TO HUMAN LIFE & THE ENVIRONMENT, I FIND THE END RESULT - NUCLEAR POWERED ROCKETS - EXTREMELY DANGEROUS & UNNECESSARY. I URGE YOU NOT TO PROCEED WITH THIS PROJECT. I COMPLETELY AGREE WITH CONGRESSMAN WAYNE OWENS COMMENTS ON THIS PROJECT. PLEASE APPLY YOUR TIME, MONEY, & RESOURCES OF THE AIR FORCE TO MORE USEFUL MATTERS.

THANK YOU

[signature]

Name: KIM G. ROGERS

Address: 2323 E. HIGH MOUNTAIN DR SANDY UT 84092
Street Address — City / State / Zip Code

Please hand this form in or mail to:
[illegible]
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 179

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

9/12/92

Capt. Scott Hartford
Brooks Air Force Base
Texas, 78235-5000

I am a concerned US citizen and resident of St. George Utah. I attended the public meeting held in St. George on 9/11/92 concerning the SNTP draft EIS. I had some concerns about my own health safety as well as my family and friends before attending friday nights meeting. As I sat through your presentation and heard comments from other residents voicing concern about their health, my thoughts were on past days. I visualized how a similar meeting years ago may have been; as the good residents of St. George were given the assurance, because of data gathered from studies made, that the testing that was to be made would not cause them any concern because of any health dangers.

1 12.33 I feel as you proceed with the EIS draft, consideration be given as to how reports can give the false sense of public health safety. Let us learn from times past. Although the Propulsion Program my be of value I feel the danger that can come to any citizen of this great country is more important. It would be easy for me to recommend another site, but I can not wish something on someone else that has even the remotest possibility of causing a health hazard to them. So I hope you reconsider and arrive at a suggested site that truly can be safe for the general public.

Chuck Schenck

3066 Chestnut Circle
St. George, Utah
84770

Please hand this form in or mail to:
[illegible]
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 180

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-16-92

I object vigorously to testing by your agency and other government agencies and officials which seem to indicate that what the American people don't know won't hurt them. [illegible] which indicate that taxpayer money may be spent in any way that comes to mind without prior public knowledge or approval. I totally am not in favor of testing this nuclear device in Nevada test site. I am not in favor [illegible] of money being spent to test it [illegible] at this time. A 13.6 It is irrelevant. We have major disasters at hand that have caused billions (not millions but billions) of dollars worth of damage. Our national debt is in the trillions. I don't believe that spending hundreds of millions of dollars on testing

over

Name: E. Keller

Address: [illegible] St George Ut [illegible]
Street Address — City / State / Zip Code

Please hand this form in or mail to:
[illegible]
Attn : Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 180

this rocket is in the best interests of the american people or our country at this time. Our children are not receiving an, even adequate education, So that they may compete with the rest of the world. The number of people each year who slip into poverty continues to increase. The internal problems continue to increase in this country. How can you justify spending tax dollars in this way? Especially when it seems that no one wants the money to be spent this way, on something not wanted nor required. All of this and the question of radiation as well. Seems to me that the "downwinders" were also told that the testing would be safe. any risk to life is not acceptable. Any lack of respect for life abhorrent.

Document 181

[illegible]
Governor
[illegible] V. [illegible]
Director

[illegible]
Phone [illegible]
FAX [illegible]

DEPARTMENT OF COMMERCE

September 17, [illegible]

Captain Scott Hartford
[illegible]
Building 1155
Brooks AFB, TX [illegible]

Dear Captain Hartford:

The Space Nuclear Thermal Propulsion Program (SNTPP) is ideally suited for a "hand-in-glove" fit with the Idaho National Engineering Laboratory (INEL). Idaho's choice offers many key advantages which set it apart from the other proposed site. The most important of these are:

- An existing technological base composed of the "best-in-the-business" nuclear reactor experts. The INEL has well over forty years of experience in nuclear reactor design, testing and safety, and is the birthplace of the nuclear navy and commercial nuclear electrical power production.
- Nearly $5 billion in existing facilities, including laboratories, office space, machine shops, assembly bays, computer centers, and other support services, e.g. fire protection, cafeterias and security.
- Existing road, rail, and bus transportation connecting the INEL to nearby communities and heavy manufacturing centers located in Idaho Falls, Pocatello and Boise.
- A major jet airport convenient to the laboratory for use by visiting officials, scientists and engineers, and capable of receiving heavy equipment via jumbo cargo aircraft., i.e. C5A Galaxie.
- The University of Idaho/Idaho State University Graduate School at INEL produces certified technologists and M.S. and Ph.D. scientists and engineers in every technical area in which INEL is involved.
- Future expansion of the SNTPP can be easily accommodated at (Test Area North) TAN, which is part of the INEL complex situated on 890- square miles of already-dedicated land and facilities.

IDAHO

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Captain Scott Hartford
September 17, [illegible]
Page Two

- TAN facility will provide total containment of the SNTPP for all phases of operations. In Idaho the SNTPP will be operated "indoors" from inception to completion. TAN's Hot Shop can be used to receive spent fuel and to transfer the fuel into storage casks by remote handling. TAN's Warm Shop can be used for testing of containment shielding, heat transfer and design.
- Proximity to outstanding world-class recreation facilities including Yellowstone-Teton National Parks, Sawtooth National Recreation Area, pristine alpine lakes and Sun Valley.

13.1 A | We strongly support the SNTPP and its location in Idaho at the INEL. We are fully prepared to launch a new mission for the INEL in the exciting field of space exploration! The INEL is the only national engineering laboratory and remains the leading nuclear research facility in the United States.

Sincerely,

[illegible] V. Hawkins
Director

JVH;et

Document 182

CITY OF IDAHO FALLS
P.O. BOX [illegible]
IDAHO FALLS, IDAHO [illegible]

OFFICE OF:

September 16, 1992

Captain Scott Hartford
AFCEE/ESNP
Building 1155
Brooks AFB, TX 78235-5000

RE: SPACE NUCLEAR THERMAL PROPULSION PROJECT

Dear Captain Hartford:

To my regret, I am unable to attend the important hearing scheduled for Thursday, September 17, 1992.

At present, I am president of the Idaho Falls City Council. I have been a member of the Idaho Falls City Council for 27 years. While I have been in office, the City administrations have been very pleased to support the Idaho Nuclear Engineering Laboratory. As an elected official, I have been deeply impressed with the high standards of operation.

The City of Idaho Falls has grown up with the INEL and totally supports their activities. We offer an excellent park system, recreation programs for all ages, three municipal golf courses, a country club, low utility costs, adequate medical services and are constantly concerned about keeping community standards high for an excellent place for your employees' families to live.

13.1 A | The INEL has a quality work force ready to accept the challenge of the Space Nuclear Thermal Propulsion Program. I certainly would like to go on record as favoring the INEL having the Space Nuclear Thermal Propulsion Program.

Best regards,

Melvin L. Erickson
City Councilman
City of Idaho Falls

MLE:jds

Document 183

Pocatello

OFFICE OF THE MAYOR
[illegible]
P.O. Box [illegible]
Pocatello, Idaho [illegible]
[illegible]
FAX [illegible]

PETER J. ANGSTADT
Mayor

Pocatello City Council
[illegible]

September 16, 1992

Captain Scott Hartford
AFCEE/ESNP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

13.1 A | On behalf of the City of Pocatello, I wish to convey my support for the location of the Space Nuclear Thermal Propulsion Project at the Idaho National Engineering Laboratory (INEL).

The INEL has 40 years experience in nuclear safety testing and maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be accomplished at the INEL.

With the current technology available at the INEL, some infrastructure that could be utilized, and the track record of achievements and past performance, it makes the INEL the ideal site for this project.

We support the peaceful application of nuclear energy in the exploration of space and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

PETER J. ANGSTADT
MAYOR

/cb

Document 184

William E. Harrison
5430 Keleb Drive
Idaho Falls, ID 83401
(208) 524-4912

Mr. Chairman, Ladies and Gentlemen:

My name is Bill Harrison and I am here this evening to comment on the Space Nuclear Thermal Propulsion Technology Development Program. I have two degrees in geology, have a Ph.D. in geochemistry, and have worked as a practicing earth scientist in various parts of the world for over 30 years. My object here tonight is two-fold: First, to express support for the nuclear space propulsion program; and secondly, to offer comments as to where this program should be carried out.

The exploration of space, especially our own solar system, will occur just as certainly as did the exploration of the western hemisphere, probing of the depths of the world's oceans, and man landing on the surface of the moon. Deep space exploration offers the possibility of world-wide collaboration as opposed to international competition. The intellectual curiosity of mankind will drive such investigations as it has throughout history.

Thus, my remarks stem from a fundamental belief that space exploration will take place. It is clear that space travel will require propulsion systems which have greater payload capability, are less expensive, and have greater range and speed than those chemical systems in current use. This meeting affords us the opportunity to address one of the primary capabilities necessary to launch such space exploration efforts, namely propulsion systems. Specifically, we are here to discuss potential locations for the research and development work necessary to bring nuclear propulsion systems to reality. Because I feel that space exploration will take place, I believe that this scientific and engineering work on propulsion systems will also occur.

Because I believe these activities will proceed, I now want to raise the subject of getting the best value possible as my tax dollars are spent on this project. INEL has built nuclear reactors for decades and is one of the premier facilities in the world for such programs. The INEL complex has served as a test bed for over fifty nuclear reactors through its history and has the experience, support services, and expertise to make the space propulsion program a success. As a taxpayer, I personally want to make my investment at a facility with an established track record and thus avoid bearing the costs which always go along with the "learning curve". From the standpoint of construction, INEL has existing facilities which can be used for a portion of the proposed work whereas the alternate NTS site requires a total grass roots building effort. The NTS will require surface dirt work over twice the area required at INEL. Between 4 and 8 times as much soil will have to be moved at the proposed NTS site when compared to INEL. Although both proposed sites are located in Seismic Zone 2-B of the Uniform Building Code, INEL has a lower risk of being affected by earthquake activity as shown by

1 | historical records. Finally, INEL has completed, or is in the process of completing, several geologic and seismologic (including deterministic and probabilistic hazards assessment) studies in connection with another
10.3 | investigation. These studies have provided fundamental understanding as to the cause-and-effect relationships pertaining to the seismically quiet

1

Document 184

William E. Harrison
5430 Keleb Drive
Idaho Falls, ID 83401
(208) 524-4912

1 cont'd | (aseismic) nature of the Eastern Snake River Plain. To date, these studies have required over $6 million and represent a front-end investment which will
10.3 | not have to be duplicated for the space propulsion program, should it be situated at the INEL. These observations can be equated directly to dollars,
A | and I believe that an objective cost-benefit analysis will show that the Air
13.1 | Force/DOE team will be able to produce a superior nuclear propulsion system product at a significantly lower cost if this program is located at INEL.

Thank you.

Document 185

University of Idaho
Idaho Falls Center for Higher Education
1776 Science Center Drive
P.O. Box [illegible]
Idaho Falls, Idaho [illegible]
208-[illegible]
FAX: 208-[illegible]-1442

September 14, 1992

Captain Scott Hartford
AFCEE [illegible]
Building 1155
Brooks AFB, TX 78235-5000

A
13.1 | This letter is in support of locating the Space Nuclear Thermal Technology Project at the Idaho Nuclear Engineering Laboratory in Idaho Falls, Idaho.

Please be advised that the Idaho Falls Center for Higher Education consisting of a consortium of three Universities, University of Idaho, Idaho State University and BYU-Ricks, can provide the continuing educational opportunity necessary for the recruitment and retention of personnel to the project.

I have enclosed a brochure describing the University of Idaho program in Idaho Falls. This program is directed toward graduate degrees in engineering and science and as such, responds to the higher educational needs of INEL.

Since higher educational opportunities may be a key factor in your decision, I thought it appropriate to advise you of such opportunities in the Idaho Falls area.

Yours very truly,

Fred H. Tingey
Director

Enc: 1

Document 186

1

275 Chamberlain Avenue
Idaho Falls, ID 83402
September 17, 1992

AFCEE/ESNP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

RE: SPACE NUCLEAR THERMAL PROPULSION PROGRAM—COMMENTS ON EIS DRAFT

Dear Captain Hartford:

My name is Jon Gahl. I was born and reared in Idaho Falls. As a candidate for State Representative, and as an independent businessman, I support siting the Space Nuclear Propulsion Project (SNTP) at the Idaho National Engineering Laboratory (INEL). The purpose of this hearing is to discuss environmental impacts. As a member of the environmental community, and as a founder of Friends of Fall River, I am sensitive to impacts to our environment.

When our group was evaluating the worthiness of the Fall River Hydroelectric Project, I frequently asked for help from experts at the INEL. Besides having experts in nuclear engineering, INEL employs mechanical, electrical, chemical, and civil engineers. Less known is the fact that INEL employs biologists, geologists, archaeologists, ecologists, and scientists in related fields. I can assure you that these scientists are concerned with the environment and have the ability to monitor any potential impacts to our environment. In addition to their professional competence, these scientists care about the quality of our environment from an aesthetic and moral standpoint.

The reasons for siting the SNTP Project in Idaho are numerous:

1. Existing containment and handling facilities
2. Economic benefits of utilizing existing facilities
3. Expertise in environmental monitoring
4. More experience in nuclear reactors than all other national facilities combined
5. Public and political support

A
13.1 | I wholeheartedly support siting the facility in Idaho, for if the SNTP Project can be safely constructed anywhere in the world, it would and should be here.

Sincerely,

Jonathan R. Gahl

Document 187

West One Bank, Idaho, N.A.
[illegible]
Idaho Falls, Idaho [illegible]
[illegible]

West One
Bank

Captain Scott Hartford
AFCSR/XRP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A 13.1 We support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

J[illegible] R. Countryman
Vice President/Manager

Document 188

University of Idaho
Office of the Provost
Moscow, Idaho 83843
[illegible]
FAX [illegible]

September 15, 1992

Captain Scott Hartford
AFCSR/XRP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

I am pleased to join members of the Idaho Falls Chamber of Commerce, INEL employees, and others in welcoming you to Idaho. I regret that I am unable to attend this hearing because of the concurrent September State Board of Education meeting in Moscow.

The University of Idaho is an enthusiastic participant in the three-university consortium which is the Idaho Falls Center for Higher Education. The center provides a broad range of higher education opportunities which would be available to personnel of the Space Nuclear Thermal Technology Project. The center has already proven itself a key to recruitment and retention of personnel at INEL as well as providing a continuing education opportunity for their family members and local residents.

The scientific and technical community is particularly well served by University of Idaho graduate programs. These include master's level programs in computer science, chemistry, physics, industrial safety, mathematics, metallurgy, and engineering. Doctoral programs are offered with majors in chemical, mechanical, civil, electrical, nuclear, and metallurgical engineering, physics, and chemistry.

Another factor in the recruitment and retention of senior scientific personnel at INEL is the opportunity provided to those meeting academic requirements to serve as affiliate faculty of the University of Idaho.

Also, the potential for cooperative research projects with the university on challenging and intriguing problems of particular interest to the INEL programs or for basic research is also attractive to these scientists and technological personnel at INEL.

The University of Idaho is proud to be part of the scientific and technological research and development community in Idaho Falls and to serve the INEL personnel through its statewide teaching, service, and research mission in science and engineering fields.

Sincerely,

Thomas O. Bell
Provost

TOB:lf

[illegible]

Document 189

September 17, 1992

Captain Scott Hartford
AFCSR/XRP
Building 1155
Brooks AFB, Texas 78235-5000

A 13.1 I am a strong supporter of the Space Nuclear Thermal Propulsion (SNTP) program, and for that matter, all Space Research activities. I believe that Idaho and the Idaho National Engineering Laboratory is the place to site the SNTP. With the reduction in World tension and decreases in some areas of Military spending, we can and should now turn back to the more important issues of man's destiny in space and I want Idaho to be part of it.

I have examined the Preliminary Environmental Impact Statement for SNTP and have the following supportive comments.

The INEL offers existing buildings, roads, equipment, and people to support the full range of activities in the SNTP program in the most cost-/efficient manner. Because the INEL already has the technical team and facilities needed to make the program successful, testing could be started sooner and cost less at the INEL than any other location being considered for the program.

The rocket being tested uses hydrogen and other gases as the coolant, so no water use is planned in the current testing process. This eliminates the need for storing radioactive liquids over the Snake River Aquifer and means no radioactive liquids could migrate to the aquifer.

This region has an experienced construction force familiar with the high standards required by the INEL who will enthusiastically support the program.

The SNTP program would offer broad economic benefits to the region, including continued INEL jobs, indirect jobs, tax revenues, maintained property values, and possibly an influx of space-related industries.

Sincerely,

David L. Crandall
David L. Crandall
[illegible] River Road
Idaho Falls, ID [illegible]

Document 190

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9/18/92

A 13.1 I fully support the Space Nuclear Thermal Propulsion project. As a tax payer I feel we should have the testing facility at the most cost effective and safety conscience site possible. I believe the INEL is the only right choice.
Most of the facilities and requirements for completion of the project are here at the Idaho site.
As a member of the community, we welcome the Air Force and the testing facility to Idaho Falls.

Name: Mary Ann [illegible]

Address: 2798 [illegible] Idaho Falls Id 83402
Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCSR/XRP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Representative of and manager of United Savings Bank
PO Box [illegible] I.F. [illegible]

Document 191

Written Comment Sheet

Space Nuclear Thermal Propulsion Program

Thank you for attending this public hearing. Our purpose for hosting this meeting is to give you an opportunity to comment on issues analyzed in the SNTP Draft Environmental Impact Statement. Please use this sheet to comment on any environmental issues that you feel should be clarified in the Final Environmental Impact Statement.

Date: 9-20-92

A
13.1 I strongly support the SNTP program at INEL. I agree with the other speakers at the public hearing that the INEL is the best suited for the program. I believe that
- SNTP program should be carried out because it will keep our scientists and engineers at the leading age edge of technolo;
- INEL site provides both environmental and economical choice.
- INEL has dedicated, professional staff needed for successful completion of the program.

Name: Vikram N. Shah

Address: 805 Masters Dr Idaho Falls ID, 83401

Street Address — City / State / Zip Code

Please hand this form in or mail to:
AFCEE/ESEP
Attn: Capt Scott Hartford
Brooks Air Force Base, TX 78235-5000

Document 192

September 18, 1992

Captain Scott Hartford:
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

A
13.1 I support the Space Nuclear Propulsion Program at Idaho.

The Idaho National Engineering Laboratory (INEL) has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing, and safety. These technical skills are necessary for the United States to have the Space Nuclear Thermal Propulsion technology development program.

The INEL has the facilities to do space nuclear thermal propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

Again, I support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

David E. Shropshire, PE
Principle Project Engineer
EG&G Idaho, Inc.

Document 193

340 E. Anderson
Idaho Falls, Idaho 83401
(208) 524-1010

September 16, 1992

Captain Scott Hartford:
AFCEE/ESEP
Building 1155
Brooks AFB, Tx. 78235-5000

Dear Capt. Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at INEL.

A
13.1 I support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

[illegible]
General Manager

Document 194

PERFECT LEARNING, INC.

September 18, 1992

Captain Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford,

The Idaho Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A
13.1 We support this program and encourage your support to locate this technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

Bob Hawkins
PerLearning, Inc.

910 S. Lincoln Rd. Idaho Falls, Idaho 83401 — 208-[illegible] FAX [illegible]

Document 195

Anderson, Pike & Bush
A PROFESSIONAL ASSOCIATION
ATTORNEYS AT LAW

September 18, 1992

Scott Hartford, Captain
AFCEE/ESEP
Building 1155
Brooks AFB, Texas 78235-5000

Dear Captain Hartford:

We in Idaho are extremely proud of the Idaho National Engineering Laboratory, its people and equipment. While I am not of scientific bent, I firmly believe the facilities and
A the staff at the INEL have the capability and expertise to
13.1 capably handle the Space Nuclear Propulsion Program. Your support and encouragement to locate this technology at the INEL would be most welcome and deeply appreciated.

Very truly yours,

John W. Sharp

JWS/kc
HART/JWSC

Document 196

KIM D. SMITH
Compliance Officer
Assistant Manager
Northgate Office

The Bank of Commerce

September 15, 1992

Captain Scott Hartford:
AFCEE/ESEP
Building 1155
Brooks AFB, Tx 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A We support this program and encourage your support to locate this
13.1 technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

Mr. Kim D. Smith

KDS/tll

P.O. Box 1887 • Idaho Falls, Idaho 83403 • [illegible]

Document 197

2195 Ironwood Dr.
Idaho Falls, ID 83402
Sept. 14, 1992

Captain Scott Hartford:
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

The Idaho National Engineering Laboratory has 40 years experience in nuclear safety testing. The INEL maintains a staff with worldwide recognized expertise in nuclear reactor design, testing and safety. These technical skills are necessary for the United States to have the Space Nuclear Propulsion Program.

The INEL has the facilities to do space nuclear propulsion test preparation, testing, post-test analysis, disassembly and processing of radioactive materials for future reuse or disposal as needed. All phases of the program could be done at the INEL.

A We support this program and encourage your support to locate this
13.1 technology at the INEL, the leading nuclear research facility in the United States.

Sincerely,

Document 198

National Aeronautics and
Space Administration

Lewis Research Center
Cleveland, Ohio
44135

NASA

Reply to Attn of: 6020

October 16, 1992

TO: Captain Scott Hartford

FROM: Nuclear Propulsion Office

Subject: SNTP DEIS Comments

This is a complete and high quality technical document which will stand on its own. Overall, it is very well written and it contains a substantial quantity of highly relevant information. It is obvious that considerable effort went into its preparation. During the review process some comments were offered and are as follows.

1 1. The ground test siting alternatives are limited to NTS in Nevada,
3.1 and INEL in Idaho. The EIS should include some evaluation and discussion of the sites in the CIS which have recently become available, and [illegible] in Nevada.

2 2. Due to the considerable expense involved, it is likely that the ground test facilities to support the military and civilian nuclear propulsion efforts will have to be shared. The commonly held belief is that constructing one test facility, built to meet the most stringent technical requirements, will cost much less than constructing two facilities optimized to meet separate
1.24 requirements. The test facility capabilities described in the DEIS do not meet those needed for civilian program verification tests.

In particular, the effluent treatment system described is not feasible for the relatively long, full power tests anticipated in the civilian test program. The expense and logistical support required for the hydrogen [illegible] cooling system described are quite high. Water cooling should be explored at the sites where water is available.

3 3. The text supporting "Selection of Reference Case Scenarios, [illegible] II" is difficult to understand. Since these cases are used extensively in the analysis that follows, this section should
1.18 be expanded in a way which would make it understandable to non-experts. Also, one paragraph listing all common circumstances would be appropriate, followed by a paragraph for each case which illustrates the differences.

Document 198

4 4. [illegible] it [illegible] This point is only [illegible] in section 1.1. It would seem that [illegible] this effort deserves more [illegible] this point, or it may be [illegible]
2.1

5 5. Section 1.2 would have much more impact if stated in terms of the [illegible] "Broad Mission Applicability". [illegible] support the claim from section 1.1: "This concept (NTP) enables a substantial number of missions and [illegible] with other conventional propulsion...". A list of missions with a brief explanation should be included, at a minimum.
2.1

6 6. The second bullet in Section 1.2 is not complete or meaningful to [illegible]. [illegible] the phrase to a way which would be [illegible] to the public would help: e.g. "High specific impulse substantially reduces propellant quantities required and increases payload".
2.1

7 7. There is considerable data regarding releases to the environment as a result of ground test operations, but little about reactor releases during space flight. Will the ground test data be used to extrapolate to flight conditions? A brief discussion of how the ground test results might be used to determine the environmental impacts of space deployment would help the public understand the larger issues.
2.2

[illegible] J. Taylor

Document 199

PLANNING DEPARTMENT
DRAWER L • INDEPENDENCE • CALIFORNIA [illegible]
OFFICE (619) 878-2411 [illegible]
FAX (619) 878-2[illegible]

File 15-3-10 [illegible]

County of INYO

Roger DeHart
Planning Director

October 13, 1992

Captain Scott Hartford
United States Air Force
AFCEE/ESEr
Building 1155
Brooks AFB, TX 78235-5000

SUBJECT COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED SPACE NUCLEAR THERMAL PROPULSION PROGRAM

Dear Captain Hartford:

1 Inyo County is pleased to comment on the above mentioned Draft Environmental Impact Statement (DEIS). The delay in providing these comments to you is a result of a deficiency in the DEIS notification and distribution process that is the subject of our first comment:

Although the Radiological Analysis Region (Figure 4.12-3) includes over 20,000 square kilometers (over 20% of the Radiological Analysis Region) in Inyo County, neither Inyo County nor the State of California were included on the DEIS mailing list.
1.8

This is of concern especially in light of the fact Indian tribes throughout Inyo County, and as far away as Benton, California (in Mono County) are listed in the DEIS mailing list (Appendix C). The County was fortunate enough to notice an article in a Nevada newspaper regarding this project. This lack of notification is typical of projects proposed for the Nevada Test Site (NTS). We often refer to the "Stateline Fault" that apparently shields Inyo County and its residents from the impacts of projects conducted at NTS. We are somewhat surprised to find the Air Force recognizing this mythical geologic feature.

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After preliminary review of the DEIS, Inyo County would like to make the following additional comments:

2 1. The need for the proposed action is not clearly stated in the DEIS. The presumption (taken from the fact the Air Force is the lead agency and NASA seems to have no involvement) is that the Space Nuclear Thermal Propulsion (SNTP) program is strictly military in nature, but as the DEIS is not classified, a clearer description of the civilian and/or military uses planned for the SNTP system is justified. Is this project to be used in the Space Defense Initiative, or some other Air Force space program?
2.1

3 2. There is almost no discussion of the amounts of radiation/radioactive materials that would be released "at the nozzle" when this propulsion system is operational. The description (Section 2.2.1) implies that this is just another rocket system, one that uses a reactor to superheat the rocket fuel. Later discussions of the test cell (i.e. hot cell) needed to house the Ground Test Articles (GTAs) - the reactor engines - and the Effluent Treatment System, coupled with the comment that the SNTP system would be for a "upper stage rocket engine", leads to the conclusion this engine may be as "dirty" as the reactor rocket engine tried once before. Have the environmental impacts of operating the SNTP system in the upper atmosphere or in low earth orbit been addressed, and if so, where?
1.2

4 3. A comparison of the information in figure 2.3-2, figure 3.3-1 and figure 3.8-1 reveals a potential conflict between the security intensive activities contemplated in this DEIS and the public, civilian activities performed by the DOE Office of Civilian Radioactive Waste Management at Yucca Mountain. It is likely, given the number of public and special tours being conducted around Yucca Mountain, that tour busses may well wind up sharing either Jackass Flats Road or Lathrop Wells Road with shipments of "irradiated specimens" or engine components. This potential safety issue should be addressed in the DEIS.
12.01

5 4. The brief discussion in section 4.5.1.3 Radioactive Hazardous Waste gives no indication of the eventual disposal of the up-to-ten reactor cores full of irradiated fuel. Will the fuel assemblies be stored with the other military spent fuel at Idaho National Engineering Laboratories?
6.1

6 5. In conjunction with comment #3 above, the division of populations at risk during severe accidents (Appendix K, Section 2.4 Accident Scenarios) needs to be reviewed. The assumption cannot be made that the at-risk public exposure area begins at the NTS facility fence. An additional analysis should be done for each scenario using a wind direction to the south west, assuming the public is either at the Yucca Mountain Field Operations Center, or on top of Yucca Mountain, whichever is most conservative.
12.02

Document 199

The above comments are not intended to be exhaustive, but are indicative of our concerns. Inyo County appreciates the opportunity to comment on the Draft Environmental Impact Statement for the Space Nuclear Thermal Propulsion program. We would appreciate both a response to our comments, and the opportunity to participate in the review of future developments in this program.

Sincerely,

Roger De Hart

Roger De Hart
Planning Director

Document 200

James P. Fatsell

October 2, 1992

Captain S. Hartford
AFCEE/ESE
Brooks AFB, TX 78235-5000

Dear Captain Hartford:

I would like to comment on the EIS for the SNTP. As long as the effects of siting this project have been examined in excruciating detail, one might as well
1 address the effect that not placing it might have on the two sites.

Idaho Falls and the surrounding communities are small and rely heavily on the work at the INEL. Some projects are being lost or reduced at the INEL. Siting the SNTP at the INEL, rather than causing an impact
4.3 on the community, would actually prevent an impact that other program reductions would have caused.

Though I can not speak for Nevada, their economy is much more diverse than Southeast Idaho's and I suspect that failure to site the SNTP in Nevada would not change the status quo (minimum impact), while siting the SNTP at the INEL would prevent community decline (minimize impact). Clearly, if minimum impact is desired, the SNTP should be sited at the INEL.

Sincerely,

Fatsell

Document 201

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, Ca. 94105-3901

October 29, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Dear Capt. Hartford:

The U.S. Environmental Protection Agency (EPA) has reviewed the Space Nuclear Thermal Propulsion (SNTP) Program/DEIS, issued by the Department of the Air Force (federal lead) with the Department of Energy as cooperating agency. Our review is provided pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act. We appreciate that the Air Force granted EPA an extension past the closing of the public comment period, October 5, 1992, to submit comments. EPA Region IX's review has been coordinated with Region X, since one of the sites evaluated for SNTP is at the Idaho National Engineering Laboratory; the second site being considered is in Region IX, at the Saddle Mountain Test Station within the Nevada Test Site.

In the proposed program, the Air Force would develop technology for and test a particle bed reactor (PBR) propulsion system which could power an advanced upper stage rocket engine. In theory this engine could provide greater thrust-to-weight and efficiency in using the propellant (hydrogen) than conventional propulsion systems. However, specific applications for such an engine are not described in the DEIS. The PBR design and related technologies for the testing facility, such as the treatment system for radioactive effluent, are described conceptually. As characterized in the DEIS, the proposed action entails three decisions: whether to continue the SNTP program using nuclear thermal propulsion; whether to construct and operate a PBR validation test facility; and where to site the test facility.

Because the DEIS provides little information on the considerations regarding continuation of the SNTP program and evaluating the performance and costs of nuclear thermal propulsion relative to alternatives, our review focuses on the environmental and health and safety issues associated with
1 project design and siting. However, we do recommend that the FEIS include background information on why NTP would be
2.4 considered preferable to other rocket propulsion technologies, and anticipated costs of the SNTP program, as proposed.

Printed on Recycled Paper

Document 201

We have rated this proposal/DEIS EC-2 (environmental concerns-- insufficient information; see enclosed rating sheet). While the DEIS adequately describes the regulatory requirements applicable to the proposal and anticipates designing the facility and control technologies to comply, specifics of design and
2 performance have not yet been determined. From a regulatory perspective, we emphasize that the facility must comply with the National Emission Standards for Hazardous Air Pollutants; a
12.83 permit to construct must be obtained from EPA unless forecast emission levels fall below the permit threshold. At a meeting with EPA in September 1991, the Department of Energy indicated that it intends to apply for a permit even if emission levels are not anticipated to exceed the threshold.

3 Additionally, the DEIS does not address the question of long-term handling of the high level radioactive fuels used in the reactors for the sub-scale and full-scale test facilities.
6.31 Although this is not part of the Air Force proposal, it is a related effect; the FEIS should provide information on handling and disposal of this material after use at the facility. Additional comments are attached.

We appreciate the opportunity to review this DEIS. When the Final EIS is filed with EPA Headquarters, please also send two copies each to EPA Region X (Environmental Evaluation Branch) and the Office of Federal Activities Region IX. If you wish to discuss these comments further, please call me at 415-744-1566, or have your staff contact Carolyn Yale (415-744-1580).

Sincerely,

Deanna M. Wieman

Deanna M. Wieman, Director
Office of External Affairs

Enclosures

001587
92-293

cc: Department of Energy
Jerry Opatz, EPA Region X
Richard E. Sanderson, EPA Washington, D.C.

Document 201

EPA Comments: Space Nuclear Thermal Propulsion Program/DEIS

4 1. Although the proposed action includes the decision whether to continue the SNTP program, the DEIS does not explain the rationale for pursuing for this technology in comparison to a "no action" alternative which would assume use of other propulsion technologies. The FEIS should provide additional background on
2.4 the historical development of nuclear powered rockets and should explain the rationale for considering nuclear thermal propulsion technology as an alternative to other propulsion technologies. A summary of other propulsion technologies which can reasonably be assumed for future use should be included in the "no action" alternative.

5 Among the overall purposes of the action, the DEIS cites reducing costs of military operations (p. 1-3) and development of "less expensive and more operationally effective access to space"
2.5 (p. 1-4). No documentation of potential cost effectiveness of the proposed technology is provided, however. The FEIS should provide information on projected costs of proposal and explain how cost of nuclear thermal propulsion compares with other propulsion options.

6 2. The nuclear reactors in the PIPET (sub-scale) facility and ground test articles (GTE) will involve high-level radioactive materials. Although the DEIS addresses assembly, handling and transportation of this material, there is virtually no discussion of the fate of fuel elements after testing has been completed. For example, the DEIS observes that "[a]fter the last test of a series, the PIPET canister assembly containing fuel elements would be removed for interim storage on site and possible transport off site for further examination or disposal" (p. 2-
6.31 10). In later sections (see pp. 4-48-49 and Appendix E) the DEIS "assumes" that irradiated fuel elements will be transported back to Lynchburg, Virginia; risks associated with this transportation are analyzed, but there is no further discussion of the fate of these fuel elements.

The FEIS must provide more information on how the fuel elements for the PIPET and GTE would be handled (reprocessing, storage, disposal) according to current programs and plans, after completion of the proposed action.

7 3. According to the DEIS, computer modeling studies "indicate that applicable regulatory limits are never exceeded either during normal operations, or as a result of credible accidents" (p. 4-25). These modeling studies appear to have dealt with
12.84 reactor operations and transportation of radioactive materials; however, it is not clear that the DEIS has taken into account potential effects of failures in the effluent treatment system (ETS) and emergency venting. For example, what is the potential

1

Document 201

7 cont. for, and risk associated with, a hydrogen explosion which could damage the NTS? The FEIS should provide an analysis of risks
12.84 associated with failure of components of the NTS and should discuss appropriate mitigation.

8 4. Compliance with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) will require more detailed technical design information and emissions evaluation as part of
12.83 the Application to Construct (40 CFR Part 61, Subpart H). These requirements were discussed at a meeting between EPA Region IX and Department of Energy staff last year (September 20, 1991, in San Francisco). At that time, DOE indicated its intention to apply for a permit to construct even if emissions are predicted to fall below permit thresholds; we support this position.

2

Document 202

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

[illegible]

EC-Environmental Concerns

[illegible]

EO-Environmental Objections

[illegible]

EU-Environmentally Unsatisfactory

[illegible] Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

[illegible]

Category 2-Insufficient Information

[illegible]

Category 3-Inadequate

[illegible] for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Proced[illegible] the Review of Federal Actions Impacting the Environment."

Document 202

BOB MILLER, Governor — STATE OF NEVADA — JUDY MATTEUCCI, Director

DEPARTMENT OF ADMINISTRATION
Capitol Complex
Carson City, Nevada 89710
Fax (702) 687-3983
(702) 687-4065

November 25, 1992

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks AFB, TX 78235-5000

Re: SAI NV # 93300027 Project: EIS, Space Nuclear Thermal Propulsion Program, Nye Clark

Dear Capt. Hartford:

Attached are the comments from the Nevada Department of Transportation and the Nevada Division of Health Protection concerning the above referenced project. These comments constitute the State Clearinghouse review of this proposal as per Executive Order 12372. Please address these comments or concerns in your final decision.

Sincerely,

Ron Sparks II
State Clearinghouse Coordinator

Enclosures

Document 202

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
1263 S. Stewart Street
Carson City, Nevada 89712

BOB MILLER, Governor — GARTH F. DULL, Director

October 5, 1992

In Reply Refer to

RECEIVED
OCT 06 1992
DEPT OF ADMINISTRATION
DIRECTOR'S OFFICE

Ron Sparks, Coordinator
Nevada State Clearinghouse
Department of Administration
Budget Division
Blasdel Building, Room 204
Carson City, Nevada 89710

Dear Mr. Sparks:

The Nevada Department of Transportation has reviewed the project titled EIS, Space Nuclear Thermal Propulsion Program, NY/Clark SAI #93300027.

Based on the information submitted we have the following comments on the proposed project.

1 Insofar as an impact to our State's Highway System, the only two items of contention were found to be nominal.

(1) Additional traffic volumes; and,
12.85 (2) Risk potential from an accident.

Additional traffic volumes during construction (maximum) are estimated to be 100 vehicles added to present ADTS. Radtran 4 modeling puts accident risk at a minimum for transport to Transuranic wastes, low level waste and both feed and fresh product shipments.

Thank you for the opportunity to review this project.

Sincerely,

D. KEITH MAKI
Assistant Director
Planning

DKM:JD:dg

cc: Larry Lunz

Document 202

[illegible]

STATE OF NEVADA

[illegible]

DEPARTMENT OF HUMAN RESOURCES
HEALTH DIVISION
RADIOLOGICAL HEALTH SECTION
[illegible]
Las Vegas, Nevada [illegible]
[illegible]

[illegible]

Date:	September 17, 1992
To:	Stan Marshall, Supervisor
From:	L. Franks, Manager/RP LF
Subject:	Comments on Nuclear Rocket Engine EIS

Per your memo of 9/14/92, I have briefly reviewed the Space Nuclear Thermal Propulsion Program EIS dated August 1992.

The obvious critical factor regarding radiological safety is the integrity of the U-235 fuel bed during operation. Opponents of the program claim the U-235 pellets will blow out. Proponents claim the fuel bed will remain intact.

If the Nevada Test Site is chosen for this program, Saddle Mountain will be the test area. This is located in the geographical center of the NTS (north end of Area 14). In a worst case scenario, i.e., vaporization of the fuel bed at full power with strong winds, there could be off-site contamination.

The EIS does address radiological safety, monitoring, security, and other related aspects of test operations, but only in the most general terms. If Congress continues funding for the engine, and the NTS is chosen over INEL, detailed operational plans will be developed at that time. It may be several years before this happens. If the rocket engine does come to the NTS, we can attend the DOE/contractor staff meetings, especially those concerning radiological impacts.

This would be a major program for the NTS and we can watch the news media for all important developments. The main issue at this time is funding. I will advise you of any information I receive via DOE that is not made public.

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SEP 18 1992

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APPENDIX A

GLOSSARY OF TERMS AND ACRONYMS/ABBREVIATIONS

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GLOSSARY OF TERMS AND ACRONYMS/ABBREVIATIONS

GLOSSARY OF TERMS

Aerosolize. Release of solid or liquid materials to a gas stream as small suspended particles. The particles are created through the addition of considerable energy (heat, mechanical, etc.) to the material being aerosolized. The particulates which are created can generally be trapped using appropriate filter media to "clean" the gas stream.

AIRDOS-PC. A computational methodology for estimating environmental concentrations and dose to man from airborne releases of radionuclides. This model is approved by EPA for use in demonstrating compliance with air quality standards.

Ambient Air Quality Standards. Standards established on a federal or state level which define the limits for airborne concentrations of designated criteria pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, lead, ozone, and particulate matter [PM_{10}]).

As Low As Reasonably Achievable (ALARA). An approach to radiation protection to control or manage exposures (both individual and collective to the work force and general public) as low as reasonable social, technical, economic, practical, and public policy considerations permit. ALARA is not a dose limit but a process, which has the objective of dose levels as far below applicable limits as reasonably possible.

Atmospheric Dispersion. The process of air pollutants being dispersed in the atmosphere by the wind that carries the pollutants away from their source and by turbulent air motion that results from solar heating of the earth's surface and air movement over rough terrain and surfaces.

Attainment Area. An area that has been designated by the U.S. EPA and the appropriate state air quality agency as having ambient air quality [levels below the ceiling levels defined under the National Ambient Air Quality Standards (NAAQS)].

Background Radiation. Ionizing radiation present in the environment from cosmic rays and natural sources in the earth; background radiation varies considerably with location.

Baseline. The existing characterization of an area under no-project conditions.

Bounding Cases. Those credible scenarios, events, and accidents which have been identified as producing maximum environmental impacts and which, therefore, provide the basis for quantified estimates of the maximum credible consequences associated with this proposed action.

CAP-88. A computational methodology for estimating environmental concentrations and dose to man from airborne releases of radionuclides. This model is approved by EPA for use in demonstrating compliance with Air Quality Standards.

Controllable (or Controlled) Area. Those areas where trained rad-safe monitors are available, where communications are effective (where the exposure of each individual can be documented), where people can be expected to comply with recommended remedial action, and where remedial actions against uptake of radionuclides in the food chain are practicable.

Control Facility. The control facility is an earth-covered reinforced-concrete building in which the PBR validation test activities would be controlled and monitored. Other projected activities performed from the control facility include access control to the test station.

Coolant. A substance, either gas or liquid, circulated through a nuclear reactor or processing plant to remove heat.

Core Release Fraction. That fraction of the Fission Product Inventory released from the reactor core during either normal operation or during accidental release.

Core Release. The quantity of radionuclides released from the reactor core. The result of the Fission Product Inventory and the Core Release Fraction.

Cosmic Ray. Electrons and the nuclei of atoms, largely hydrogen, that impinge upon the earth from all directions of space with nearly the speed of light. Also known as cosmic radiation; primary cosmic rays.

Council on Environmental Quality (CEQ). Established by the National Policy Act (NEPA), the CEQ consists of three members appointed by the President. CEQ regulations (40 CFR Parts 1500-1508, as of July 1, 1986) described the process for implementing NEPA, including preparation of environmental assessments and environmental impact statements, and the timing and extent of public participation.

Critical Assembly. An assembly of sufficient fissionable and moderator material to sustain fission chain reaction at a low power level.

Criticality. An expression of the ability of a fission reaction to sustain itself, based upon the change in number of neutrons engaging in the fission reaction, with each such neutron being responsible for a fission event. Since not all neutrons result in a fission event (some escape or are absorbed without resulting in a fission event), a self-sustained reaction requires that enough neutrons are produced in the fission events to sustain the reaction rate after accounting for losses. Such a balanced, equilibrium situation is referred to as a <u>critical</u> reaction, which is self-sustaining (doesn't need an outside neutron source) and stable (the fission rate is neither increasing nor dropping off). A reaction which is <u>subcritical</u> is producing insufficient neutrons to offset neutron losses; hence the reaction rate will drop off if an outside source of neutrons is not present (this is the case during reactor shutdown and power reductions). A reaction which is <u>supercritical</u> produces more neutrons than are lost. This allows an increase in the reaction rate (such is the case during reactor start-up or power increases). Magnitudes of "sub" and "super" criticality are often expressed using modifiers such as "highly supercritical" (the reaction rate is increasing at a <u>very</u> rapid rate [e.g., an atomic bomb]) or "slightly subcritical" (the reaction rate is decreasing very slowly).

Cryogenic Fluids. Those fluids that are below a temperature of 150 K. In the context of this EIS, cryogenic fluids include liquid hydrogen and liquid oxygen.

Cryogenic Hydrogen. Hydrogen at temperatures below 150 K, which has been transformed from a gas to a liquid. Cryogenic hydrogen may be used as both a coolant and propellant.

Cultural Resources. Any building, site, district, structure, object, data, or other material significant in history, architecture, archaeology, or culture.

Cumulative Effects. The aggregation of project included effects within the project's Region of Influence. The term cumulative has also been used to denote aggregated effects over several years as against net effects in a given year.

Dacite. A fine-grained extrusive igneous rock consisting of plagioclase and quartz minerals, together with either hornblende, biotite (mica), or pyroxene.

Decommissioning. The permanent removal from service of the surface facilities and components of the validation test facility.

Decontamination. The removal of unwanted material (especially radioactive material) from the surface of or from within other material.

Deflagration. Combustion in which the flame speed is below the speed of sound.

Detonation. Combustion in which the flame speed is above the speed of sound.

Dewar. A double-walled glass or metal flask container that is well insulated with a vacuum in the annulus. It is used for storing liquified gases and hot or cold fluids. Large vessels are used for truck and rail movement of liquified gases.

Disturbed Area. Specific land area which has had its surface altered by grading, digging, or other activities related to construction.

Dose Commitment. Dose commitment is that total radiation dose equivalent, internal or external in origin, to the whole body or specified part of the body, that will be received during the 50-year period following the release of radioactive material to the specific environment. Dose quantities that apply to the "Whole Body" shall also apply to the head and trunk, active blood-forming organs, gonads, and lens of the eyes. Dose quantities that apply to "Other Organs" shall apply to those organs not specified above.

Dose Equivalent (H). The product of absorbed dose (d) in rads in tissue, a quality factor (Q), and other modifying factors (N). Dose equivalent (H) is expressed in units of rem.

Effluent. Waste material discharged into the environment. In the case of this EIS, the major effluent of concern is that produced by the testing of the ground test articles.

Effluent Treatment System (ETS). A system designed to remove fission contaminants generated as a result of ground testing activities. The ETS would be designed to treat radioactive particulate, iodine, and noble gas releases.

Emission Factor. The rate at which a pollutant is emitted from a point, line, or area source.

Endangered Species. A species that is threatened with extinction throughout all or a significant portion of its range. Defined by the Endangered Species Act, as amended (16 USC 703 et seq.).

Engine Nozzle. The orifice through which hot propellant is ejected to initiate thrust.

Engine Integration Test (EIT). A test designed to demonstrate the propellant management system without an operating reactor in the loop. Heat would be generated by combusting hydrogen in an oxygen-rich environment.

Environmental Radiation. The summation of all naturally occurring and man-induced radiation exposures an individual residing in a region receives. This includes the contributions of background radiation (cosmic rays, terrestrial radionuclides and internal radioisotope deposition), radon, medical and dental x-rays, global nuclear weapons fallout, consumer and industrial products, and air travel.

Ephemeral. Lasting for a day or less.

Epicenter. The point on the earth's surface directly above the focus of an earthquake.

ETS Release Fractions. The fraction of radionuclides sent to the ETS that is released from the ETS without being treated or trapped.

Exposure rate (X). The exposure per unit time.

Fission Product Inventory. Those radionuclides created within the reactor core during operation as a direct result of the fission process.

Frit. A concentric metal cylinder that acts as a supporting structural member while being sufficiently porous to allow gas to flow through. In the PBR fuel element design, a "cold" frit is maintained at low temperatures and is used to control flow and pressure drop. A "hot" frit operates at high temperatures and forms a companion cylinder to the cold frit, confining and supporting the fuel particles.

Fuel Element. The smallest structurally discrete part of a reactor or fuel assembly that has nuclear fuel as its principal constituent. The term fuel element is a general term and a more precise term such as fuel pellet, plate, rod, pin, cluster, bundle, subassembly, or assembly should be used.

Fuel Kernel. The center of a fuel particle which contains the enriched uranium.

Fuel Particle. A tiny microsphere that contains fissile material. It consists of either a kernel of highly enriched uranium carbide, concentric carbon layers of varying densities, and one or more refractory coatings.

Full-Scale Facility. The sub-scale facility expanded to accommodate the EIT, mini-GTA, and GTA testing activities. Additional upgrade from the sub-scale facility includes additional testing cells, coolant storage and control instrumentation.

Gigawatt. A unit of power equal to 1 billion watts.

Ground Test Articles (GTAs). A series of up to ten reactors which, as they are tested, gradually approach the desired prototypic conditions. The mini-GTAs are sub-scale test articles while the GTAs are full-scale test articles.

Halogens. Any of the elements that form part of group VII A of the periodic table and exist in the free state normally as diatomic molecules; these include fluorine, chlorine, bromine, iodine, and astatine.

Hot Hydrogen Gas Generator. A unit that produces hot hydrogen gas (approx 2,700 K; 2,430° C) by combusting hydrogen in an oxygen-rich environment. The hot hydrogen gas generator is used as part of the Engine Integration Test.

Inversion. A reversal of a normal atmospheric temperature gradient, causing increasing temperatures with height.

Ionizing Radiation. Radiation that can displace electrons from atoms or molecules, thereby producing ions.

Irreversible and Irretrievable Commitment of Resources. Involves land areas committed during operation, funding for construction and materials, chemicals, and water that would be consumed during construction and operation and would be unable to replace.

Isotope. Atoms of an element that contain the same number of positive nuclear charges and have the same extra-nuclear electronic structure, but differ in the number of neutrons.

Joule. A unit of energy of work equivalent to 1 watt per second, 0.737 foot-pound, or 4.18 calories.

Kelvin (K). A temperature scale that designates absolute zero as 0 K(-273°C).

Land Disposal Restrictions (LDR). Hazardous wastes which are subject to restrictions for land disposal as identified and defined in 40 CFR Part 268.

Latent Cancer Fatality (LCF). A death from cancer which is attributed to exposure to ionizing radiation.

Low-Level Waste (LLW). All radioactive waste not classified as high-level waste, spent nuclear fuel, transuranic waste, uranium mill tailings or Mixed Waste. LLW can contain transuranic nuclides in concentrations not greater than 100 nanocuries per gram.

MELCOR Accident Consequence Code System (MACCS). A gaussian-diffusion computational methodology for estimating environmental concentrations and dose consequences to man from airborne releases of radionuclides. This model was developed by Sandia National Laboratories.

Maximally Exposed Individual (MEI). The hypothetical individual receiving the highest potential dose (the MEI dose) as a result of a radiological release, or series of releases. The MEI dose is calculated from the sum of all release-related external and internal exposures received during a fifty-year period following the release, based upon the presence of the hypothetically exposed individual at the location where the highest exposure occurs for the <u>entire</u> fifty-year exposure duration. The MEI dose is used for comparison with regulatory (NESHAP) requirements for airborne releases of radioactive material.

Megajoule. A unit of energy equal to one million joules. Work performed when power is expended at the rate of 1 megawatt for 1 second.

Megawatt. A unit of power equal to 1 million watts.

Mesozoic. A period of geologic time extending from about 245 million to 66 million years ago.

Millirem. A fractional unit of a rem. 1 millirem = 1/1,000 rem.

Mini-GTA. The sub-scale test article tested prior to the Ground Test Article (GTA).

Mitigation. Methods to reduce or eliminate adverse project impacts.

Mixed Waste. Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act, respectively.

National Environmental Policy Act (NEPA). Public Law 91-190, passed by Congress in 1969. The Act established a national policy designed to encourage consideration of the influences of human activities (e.g., population growth, high-density urbanization, industrial development) on the natural environment. NEPA also established the Council on Environmental Quality. NEPA procedures require that environmental information be made available to the public before decisions are made. Information contained in NEPA documents must focus on the relevant issues in order to facilitate the decision-making process.

National Priorities List (NPL). A list of sites (federal and state) that contain hazardous materials that may cause an unreasonable risk to the health and safety of individuals property, or the environment.

Nonattainment Area. An area that has been designated by the U.S. EPA and appropriate state air quality agency as exceeding one or more National Ambient Air Quality Standards.

Normal Operation. The range of full-power operation conditions that can be achieved when seasonal variations in ambient conditions are taken into account.

Nuclear Element Tests (NET). A series of tests designed to demonstrate the integrity and performance of fuel element designs under conditions of high temperature and moderate hydrogen flow.

Operational Boundary. The operational boundary is the reactor building (or the nearest physical personnel barrier in cases where the reactor building is not a principal physical personnel barrier) where the reactor chief administrator has direct authority over all activities. The area within this boundary shall have prearranged evacuation procedures known to personnel frequenting the area.

Orbital Transfer Vehicle (OTV). An OTV can be thought of as a reusable, space-based tugboat. Once deployed in low earth orbit (LEO), an OTV would be sent to retrieve/return a satellite in a higher orbit not accessible by the space shuttle or space station. Such a capability would allow LEO repair and servicing of expensive military satellites which are currently disposed of due to failure and/or depletion of on-board, station-keeping propellant. This leads to reduced launch costs, less space debris, and an improved amortization of military space-based assets. After use, the OTV would be reserviced by astronauts for a future retrieval mission. Because OTVs require a nearly permanent human presence in LEO, they have not been used. OTVs only become attractive with a robust space transportation system, including routine human access to space. OTVs would operate at thrust levels comparable to a launch vehicle third stage (10-50 thousand pounds).

ORIGEN. An acronym for ORNL Isotope Generation. ORIGEN-2 is the second generation of the code.

Particle Bed Reactor Integral Performance Element Test (PIPET). A series of tests designed to demonstrate the reactor fuel elements operation at prototypic power densities, temperatures, pressures, flow rates, and power durations.

Particle Bed Reactor (PBR). A nuclear reactor fueled by elements comprised of small microspheres placed in an annulus formed by a cold and hot frit. The reactor is cooled by cryogenic liquid hydrogen.

Pasquill Stability Class. Stability classes ranging from A (extremely unstable) through F (Moderately Stable) indicate the turbulent nature of the atmosphere. Extremely unstable conditions enhance diffusion (generally reducing pollutant concentrations) while moderately stable conditions inhibit diffusion and pollutant dispersion.

Plume. The elongated pattern of contaminated air or water originating at a point-source emission, such as a smokestack, or a waste source, such as a hazardous waste disposal site.

Population Center Distance. The distance from a power or testing reactor to the nearest boundary of densely populated center containing more than 25,000 residents (see 10 CFR 73.2).

Production Reactor. A reactor whose primary purpose is to produce fissile or other materials or to perform irradiations on an industrial scale. Unless otherwise specified, the term usually refers to a plutonium-production reactor. Reactors in this class include fissile material production reactor, isotope-production reactor, and irradiation reactor.

Protected Area. An area encompassed by physical barriers to which access is controlled (see 10 CFR 73.2).

Quaternary. A geologic period of the Cenozoic era extending from about 1.6 million years ago to the present.

Radioactive Waste. Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and for which use, reuse, or recovery are impractical.

Radioactivity. The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.

Radioisotope. Nuclides of the same element (same number of protons in their nuclei) that differ in the number of neutrons and that spontaneously emit particles or electromagnetic radiation.

Reactor Control. Safety rods, control drums, or other mechanisms used to control the fission process within a reactor.

Region of Influence. The geographical region which would be expected to be affected in some way by the proposed action. Generally, a region of influence is defined for each resource area associated with a proposed action.

Rem. Unit of exposure to biological material calculated by multiplying the dose (in rads) by a quality factor which accounts for the biological effectiveness of the type of radiation producing the exposure.

Remote Inspection and Maintenance System. Inspection and maintenance of radioactive or contaminated equipment by means of a manipulator or robot.

Rhyolite. An extrusive igneous rock similar in composition to granite, but with much smaller crystal sizes (finer-grained), and often showing characteristics of flow.

RSAC-4. A gaussian-diffusion computational methodology for estimating environmental concentrations and dose consequences to man from airborne releases of radionuclides. This model was developed at the Idaho National Engineering Laboratories.

Rural Zone. A rural zone is a sparsely populated but not directly controlled area or neighborhood where evacuation of all personnel can be achieved in less than 2 hours using available resources.

Sintering. Process for heating alloys to a temperature less than the melting point.

Site Boundary. The site boundary is that boundary, not necessarily having restrictive barriers surrounding the operations boundary, wherein the reactor administrator may directly initiate emergency activities. The area within the site boundary may be frequented by people unacquainted with reactor operation.

Site-Specific. Characteristic of a geographically defined location that may vary considerably from characteristics of adjacent locations or the characteristics of a larger area within which the location in questions is contained.

Solid Wastes. Waste material that is an essentially in a dry, solid form. Waste may include well-drained containers or liquids which have been entrapped or otherwise solidified so that they will retain their solid form without the presence of free liquids during handling, transportation, storage, or disposal. Viscous waste material is determined to be a solid by testing in accordance with American Society for Testing Materials Standards D4359, "Standard Test Method for Determining Whether a Material is a Liquid or a Solid."

Source Term (System Release). The quantity of radionuclides released from the test system to the environment during either operational or accidental conditions. The Source Term is the product of the Fission Product Inventory, the Core Release Fractions, and the ETS Release Fractions.

Special Nuclear Material. Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the NRC, pursuant to the provisions of Section 51 of the Atomic Energy Act of 1954, determines to be special nuclear material.

Specific Impulse (I_{sp}). Specific impulse is a measure of the effectiveness of a rocket engine and is expressed in units of time (seconds); it represents the capability of generating a unit of force (pounds) for a given period of time (seconds) for a unit of propellant weight (pounds).

Subcritical. See Criticality.

Sub-Scale Facility. The first phase of the ground test activity that is intended to accommodate the PIPET testing. The sub-scale facility would include a control bunker, data acquisition and instrumentation/control systems, a receiving and assembly facility, a test cell, a coolant supply system, an effluent treatment system, a remote inspection and maintenance system, roads and services, and safeguards and physical security.

Supercritical. See Criticality.

Supercritical Fluids Process. One of three processes used to create fuel kernels. This process involves the deposition of zirconium into a porous uranium-carbon kernel. Supercritical fluids are non-wetting dense gases and are obtained by controlling temperature and pressure in a controlled reaction chamber. They are used to carry the zirconium carbide precursors into the fine porosity of the kernel.

Thermoluminescent Radiation Dosimeters. These instruments measure ionizing radiation exposures from natural radioactivity in the air and soil, cosmic radiation from outer space, fallout from nuclear

weapons tests, radioactivity from fossil fuel burning, and radioactive emissions from site operation and other industrial processing.

Threatened Species. A species that has the potential to become endangered. Defined by the Endangered Species Act, as amended (16 USC 703 et seq.).

Thrust-to-Weight Ratio. A measure of the performance of a rocket engine; it is the thrust produced by the engine divided by the weight of the engine and propellant.

Transuranic Waste (TRU). Radioactive waste containing alpha-emitting radionuclides having an atomic number greater than 92 and half-lives greater than 20 years in concentrations greater than 100 nci/g.

Tuff. A general term for solidified pyroclastic (volcanic) rocks. Often refers to lithified volcanic ash or sand particles. A welded tuff is a glass-rich pyroclastic rock that has been hardened by the welding of the glass particles from its own heat.

U-235. A fissionable isotope of uranium.

Uncontrolled Area. See Controllable Area.

Upper Stage. The second or third stage of a space launch vehicle. Depending on the mission, it will ignite either in the upper reaches of the atmosphere or in LEO. On a two-stage launch vehicle, the upper stage delivers the payload to LEO while a three-stage vehicle uses the upper stage to deliver the payload to geosynchronous orbit (GEO) or an earth escape trajectory. Typically, upper stages operate between 10 and 100 thousand pounds of thrust, depending on launch vehicle and stage. Current chemical propellant upper stages are expended after use.

Urban Boundary. The nearest boundary of a densely populated area or neighborhood containing population of such number or in such a location that a complete rapid evacuation is difficult or cannot be accomplished within 2 hours using available resources.

Vaporize. Release of solid or liquid materials to a gas stream as gaseous material. Such a release requires the addition of considerable energy (usually extreme heat), especially to any solid materials being vaporized. Filter media are ineffective at trapping and separating the vaporized (gaseous) material from the rest of the gas stream.

Wetlands. Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

ACRONYMS AND ABBREVIATIONS

AADT	average annual daily traffic
AFR	Air Force regulation
ALARA	as low as reasonably achievable
ANL-W	Argonne National Laboratory West
ANS	American Nuclear Society
ANSI	American National Standards Institute
APE	area of potential effect
ARA	Auxiliary Reactor
ARCHIE	Automated Resource for Chemical Hazard Incident Evaluation
ASME	American Society of Mechanical Engineers
B&W	Babcock and Wilcox
BLM	Bureau of Land Management
BP	before present
BWMF	Bulk Waste Management Facility
C	centigrade
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CONUS	continental United States
CP-1	Control Point 1
CSS	coolant supply system
CTF	Contained Test Facility
dBA	adjusted decibel
DEIS	draft environmental impact statement
DOD	Department of Defense
DOE	Department of Energy
DOE/NV	Department of Energy Nevada Field Office
DOT	Department of Transportation
DRI	Desert Research Institute
DSB	Defense Science Board
E-MAD	engine maintenance and disassembly
EIS	environmental impact statement
EIT	engine integration test
EM	Environmental Restoration and Waste Management
EOC	Environmental Operations Center
EPA	Environmental Protection Agency
ESAAB	DOE Energy Systems Acquisition Advisory Board
ETS	effluent treatment system
FEIS	final environmental impact statement
FRMAC	Federal Radiological Measurement and Assessment Center
GH_e	gaseous helium
GH_2	gaseous hydrogen
GTA	ground test article
HEPA	high efficiency particulate air
I&C	instrumentation and control system
ICPP	Idaho Chemical Processing Plant

INEL	Idaho National Engineering Laboratory
I_{sp}	specific impulse
K	Kelvin
kPa	kilopascal
kV	kilovolt
LCF	latent cancer fatality
LDR	land disposal restriction
LH_2	liquid hydrogen
LLW	low level waste
LN_2	liquid nitrogen
LOX	liquid oxygen
MACCS	MELCOR Accident Consequence Code System
MEI	Maximally Exposed Individual
mg/l	milligrams per liter
MGD	million gallons per day
MPa	megapascals
mrem	milliroentgen equivalent man (millirem)
mrem/yr	millirems per year
MSL	mean sea level
MVA	megavolt amperes
MW	megawatts
MWMU	mixed waste management unit
NAAQS	National Ambient Air Quality Standards
NCRP	National Council on Radiation Protection
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NRDA	Nevada Research and Development Area
NRF	Naval Reactor Facility
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratories
OSHA	Occupational Safety and Health Administration
PBF	Power Burst Facility
PBR	particle bed reactor
PEIS	Programmatic Environmental Impact Statement
PIC	pressurized ion chamber
PIE	post-irradiation examination
PIPET	particle bed reactor integral performance element test
PM_{10}	particulate matter less than 10 microns in diameter
PSD	prevention of significant deterioration
psi	pounds per square inch
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
SAR	safety analysis report
SER	safety evaluation report
SARA	Superfund Amendments and Reauthorization Act

SHPO	State Historic Preservation Officer
SMTS	Saddle Mountain Test Station
SNL	Sandia National Laboratories
SNTP	Space Nuclear Thermal Propulsion
SRS	Savannah River Site
SST	safe, secure transport
TAN	Test Area North
TRA	Test Reactor Area
TRU	transuranic
UBC	Uniform Building Code
UGT	underground test
USC	United States Code
WIPP	Waste Isolation Pilot Plant
WROC	Waste Reductions Operations Complex
WSNSO	Weather Service Nuclear Support Office

SYMBOLS OF ELEMENTS/CHEMICALS

Ac	Actinium
Ag	Silver
Al	Aluminum
Am	Americium
As	Arsenic
Ba	Barium
Be	Beryllium
Br	Bromine
C	Carbon
Cd	Cadmium
Ce	Cerium
Cf	Californium
Co	Cobalt
CO	Carbon monoxide
Cs	Cesium
Cu	Copper
Dy	Dysprosium
Er	Erbium
Eu	Europium
Ga	Gallium
Gd	Gadolinium
Ge	Germanium
H	Hydrogen
Ho	Holmium
I	Iodine
In	Indium
Kr	Krypton
La	Lanthanum
Mg	Magnesium
Mo	Molybdenum
Na	Sodium
Nb	Niobium
Nd	Neodymium
NO_x	Nitrogen oxides
NO_2	Nitrogen dioxide
Np	Neptunium
O_2	Oxygen
O_3	Ozone
Pa	Protactinium
Pb	Lead
Pd	Palladium
Pm	Promethium
Po	Polonium
Pr	Praseodymium
Pu	Plutonium
Rb	Rubidium
Rh	Rhodium
Ru	Ruthenium
Sb	Antimony

Se	Selenium
Si	Silicon
Sm	Samarium
Sn	Tin
SO_2	Sulfur dioxide
Sr	Strontium
Tb	Terbium
Tc	Technetium
TCE	Trichloroethylene
Te	Tellurium
Th	Thorium
U	Uranium
Xe	Xenon
Y	Yttrium
Zn	Zinc
Zr	Zirconium

APPENDIX B

NOTICE OF INTENT

NOTICE OF INTENT
TO PREPARE AN ENVIRONMENTAL IMPACT STATEMENT
SPACE NUCLEAR THERMAL PROPULSION PROGRAM

The Department of the Air Force is conducting the Space Nuclear Thermal Propulsion (SNTP) Program to develop the technology for a nuclear thermal propulsion system. The SNTP Program Office at Phillips Laboratory, Kirtland AFB, NM is managing program activities and intends to study the environmental issues associated with the SNTP program. To this end, the Air Force Center of Environmental Excellence (AFCEE) will prepare an Environmental Impact Statement (EIS) for use in the decision-making process.

Successful development of nuclear thermal propulsion system technology would allow future consideration of the acquisition of a cost-effective rocket to support national defense and civil space missions.

SNTP Program decisions to be made include: a) whether or not to continue the SNTP program through the development of nuclear thermal propulsion technology; b) whether or not to construct and operate a ground test facility; and c) where to locate the ground test facility if the program is to continue. Decisions on whether to build a rocket for flight testing and the acquisition of operational rockets are not included in the proposed action; these decisions are not part of the SNTP technology development program.

The SNTP ground test facility is proposed to be located at either the Nevada Test Site or the Idaho National Engineering Laboratory.

Scoping will be conducted to identify environmental concerns and issues that need to be addressed in the EIS. The EIS will assess the issues pertaining to the decisions to be made. Two public scoping meetings will be held as part of the process (one each in Las Vegas, NV and Idaho Falls, ID) to determine the environmental issues and concerns that should be addressed. The scoping meetings are tentatively scheduled for April 1992. Notice of the exact time and place of the meeting will be published in the news media.

Public input and comments are solicited concerning the environmental aspects of the proposed program. To assure the program office will have sufficient time to fully consider public inputs on issues, written comments should be mailed to ensure receipt no later than May 15, 1992.

Comments concerning the proposed project or the EIS should be addressed to:

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APPENDIX C

FINAL ENVIRONMENTAL IMPACT STATEMENT MAILING LIST

FINAL ENVIRONMENTAL IMPACT STATEMENT MAILING LIST

Federal Agencies - National

Advisory Council on Historic Preservation
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Office of Project Review
1100 Pennsylvania Avenue, NW, #809
Washington, DC 20004

AEDC/SDEV
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Arnold AFB, TN 37389-2314

AFCEE/ES-S
Regional Compliance Office
Attn: Phil Lammi
630 Sansome Street, Room 1316
San Francisco, CA 94111

Brookhaven National Laboratory
Attn: Mr. Walter Kato
Building 197c
29 Cornell Drive
Upton, NY 11973

Capt Lonnie Manning
SAALC/EMP
Kelly AFB, TX 78241

Center for Environmental Health and
Injury Control (P29)
Special Programs Group
Centers for Disease Control
Atlanta, GA 30333

Det 1, AFSA/SE
Attn: Col. Matson
Kirtland AFB, NM 87117

Headquarters
Environmental Protection Agency
Office of Federal Activities (Mail Stop A-104)
Attn: Beard Young
401 "M" Street, SW, Room M-2119
Washington, DC 20460

HQ AFMC (I)/CEVC
Attn: Lynn Engelman
Building 266
Wright-Patterson AFB, OH 45433

HQ USAF/CEVP
Attn: Mr. Jack C. Bush
The Pentagon, Room 5D381
Washington, DC 20330-5130

Innovative Technology Applications
Department 6515
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Sandia National Laboratories
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Los Alamos National Laboratory
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National Technical Information Service
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Phillips Laboratory
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Sandia National Laboratories
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Environmental Coordination Office
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Forest Service - USDA
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U.S. Department of Commerce
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Director, Office of Intergovernmental Affairs
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U.S. Federal Aviation Administration
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Office of Environment and Energy
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U.S. Department of Energy
Director, Environmental Compliance Division
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Nevada Bureau of Mines & Geology
University of Nevada, Reno
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Las Vegas, NV 89101

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Salt Lake City, UT 84114

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Arco City Council
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Arco, ID 83213

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Chubbuck, ID 83202

Firth City Council
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Firth, ID 83236

Idaho Falls City Council
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Idaho Falls, ID 83405

Inkom City Council
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Inkom, ID 83245

Iona City Council
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Iona, ID 83427

Mackay City Council
P.O. Box 509
Mackay, ID 83251

Rigby City Council
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Rigby, ID 83442

Ririe City Council
P.O. Box 68
Ririe, ID 83443

Saint Anthony City Council
110 West Main Street
Saint Anthony, ID 83445

Shelley City Council
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Shelley, ID 83274

Shoshone City Council
P.O. Box 208
Shoshone, ID 83352

Warm River City Council
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Ashton, ID 83420

Local Government - Nevada

Beatty Town Board
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Beatty, NV 89003

Clark County Board of Commissioners
225 Bridger Ave.
Las Vegas, NV 89101

Eureka County Board of Commissioners
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Nye County Board of Commissioners
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Tonopah, NV 89049

Nye County Board of Commissioners
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Beaver County Commission
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Minersville, UT 84752

Beaver County Commission
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372 South 400 West
Milford, UT 84751

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70 North 400 East
Panguitch, UT 84759

Garfield County Commission
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Tropic, UT 84776

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Iron County Commission
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Iron County Commission
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Cedar City, UT 84720

Kane County Commission
Attn: Raymond R. Lopeman
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Kanab, UT 84741

Kane County Commission
Attn: C. Glen Martin
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Kanab, UT 84741

Kane County Commission
Attn: Jack Maxwell
Glendale, UT 84729

Washington County Commission
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St. George, UT 84770

Washington County Commission
Attn: Scott Hirschi
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Washington County Commission
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Pocatello, ID 83201

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INEL Technical Library
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Nevada State Library
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APPENDIX D

SAFETY ANALYSIS REPORT OUTLINE

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APPENDIX E

METHODS FOR CALCULATING RADIOLOGICAL AND NONRADIOLOGICAL IMPACTS

APPENDIX E
METHODS FOR CALCULATING RADIOLOGICAL AND NONRADIOLOGICAL IMPACTS

1.0 DEVELOPMENT OF FACILITY RADIOLOGICAL RELEASE ANALYTICAL METHODOLOGY

To determine the potential impacts of radiation releases from PBR tests and transportation of radioactive materials, studies were made using computer modeling techniques to calculate the exposure for the entire population to the release of radioactive materials, as well as the dose to the MEI from reactor operations. Bounding case assessments (i.e., maximum credible impacts) were made for both routine operations and maximum credible accident scenarios.

1.1 MODEL SELECTION

Proper selection of a computer modeling code to analyze radiological impacts is critical to the accuracy of the analysis. In recent years, improved understanding of atmospheric transportation and diffusion of contaminants has been incorporated into codes of increasing complexity, which have been developed using lessons learned from previous codes and from field studies. Several codes were evaluated to determine the best candidate for PBR propulsion technology program radiological release modeling. These include AIRDOS-PC, CAP-88, RSAC-4, and MELCOR Accident Consequence Code System (MACCS). Each of these codes is capable of evaluating the dose consequences to both the maximally exposed individual and the total dose received by the entire exposed population (population dose), which are the two primary impacts of interest.

Several factors were evaluated in selection of the best code for PBR propulsion technology program impact modeling. First is the ability of the code to address short-term releases. Operation of both PIPET and GTA will occur for relatively short periods of time (<1,000 seconds). Since this release time cannot be considered either instantaneous (a "puff") or continuous (a "plume"), an evaluation was conducted which indicated that use of a model modified to account for a short, but significant, release time yields the most conservative output results. Second, the code must have the ability to handle a large number of isotopes. Since the number of radioisotopes which would be created during PIPET and GTA operations is quite large, the greater the number of isotopes a code can handle, the more closely modeling results will reflect actual impacts. Third, the code must be able to address each of several identified exposure routes (cloudshine, groundshine, inhalation, resuspension of deposited material, and ingestion of material deposited in the food chain [water, crops, game animals, etc.]) in determining the total dosage imparted. Finally, consideration was given to

the U.S. EPA requirement that AIRDOS-PC or CAP-88 be used to assess compliance with applicable NESHAP and other air emission standards unless approval for use of another code can be obtained[1].

After evaluation of the capabilities of each of the codes, MACCS was selected as providing the most conservative analysis of the dose consequences from PBR test program radiological releases. MACCS was developed by SNL as an accident risk assessment code for the USNRC. MACCS was chosen primarily for its ability to handle a short-term release of radioactive materials with user selected meteorological conditions more conservatively than the models AIRDOS-PC and CAP-88.

MACCS was selected over RSAC-4, primarily because ingestion dosage can be treated in a more conservative fashion, thus yielding generally higher (i.e., more conservative) results. In comparisons of results from past studies performed using both MACCS and RSAC-4, MACCS was demonstrated to yield results which were somewhat higher than those obtained with RSAC-4, thus MACCS can be considered to be the more conservative code of the two (Hipp, 1991).

While both AIRDOS-PC and CAP-88 were rejected for this analysis, for comparison purposes a preliminary assessment was performed using parameters for a normal GTA run using both MACCS and AIRDOS-PC. The dose results from AIRDOS-PC were less than those for MACCS by approximately a factor of fifty, primarily due to the inability of AIRDOS-PC to properly handle short-term releases, and the limited number of isotopes which can be analyzed. Thus MACCS can be demonstrated to be the most conservative of the models investigated, and therefore, the best model for use in evaluating the upper bound of any potential impacts. However, without EPA approval for MACCS usage, either AIRDOS-PC or CAP-88 will be used in other analyses to present compliance with NESHAP.

1.2 SELECTION OF METEOROLOGICAL CONDITIONS

Unlike radiological dispersion calculations performed for continuously emitting facilities, the PBR propulsion technology evaluation facilities may be more accurately analyzed using short-time release scenarios. Typical PBR propulsion technology evaluation operations would be much less than an hour in duration, and flow times necessary for cooling are on the order of several hours. During such short-term operations, much would be known

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1 EPA provides guidance requiring on- and off-site dispersion and consequence modeling in 40 CFR Part 61, Subpart H, EPA Regulations on NESHAP. That guidance is incorporated in DOE Order 5400.5, Radiation Protection of the Public and the Environment for Modeling Off-site Doses to the Public. DOE Order 5400.5 states: "Analytical models used for dose evaluations shall be appropriate for characteristics of emissions ... mode of release (e.g., stack or vent; crib or pond; surface water or sewer; continuous or intermittent)." In addition, the order states: "Dose evaluation models that are codified, approved, or accepted by regulatory and other authorities shall be used where appropriate, such as the AIRDOS/RADRISK codes for demonstrating compliance with 40 CFR Part 61, Subpart H." Use of other models is dependent upon EPA approval, which is generally granted only if it can be demonstrated that the desired model is more conservative or accurate than the approved models (AIRDOS-PC and CAP-88).

about the volume of radiological material and the existing atmospheric weather conditions into which the operational or accidental releases could be deposited. This allows analysis to be performed using conservative data that represent the conditions at which maximum impacts will occur, rather than typical weather sampling analysis used for continuously emitting sources, where weather conditions can and do change significantly over the course of a year's operation.

Considerable amounts of historical weather data are available for both INEL and, more especially, NTS. These are provided by extensive weather monitoring and forecasting networks established at each site. Forecasting of test-time weather conditions would be undertaken starting several days prior to a planned operation. These forecasts would be updated continuously up to start of testing, and could be expected to be accurate for a period of 10 to 12 hours post-test based upon historical weather data. This procedure is already practiced at NTS, where forecasting is performed in advance of underground testing of nuclear weapons. This pre-test forecasting of weather ensures that predictable conditions will exist for the expected duration of test operations.

Two sets of bounding case weather conditions were developed for the consequence analysis: model operating weather and potential accident-case weather. Normal operating weather conditions (hereafter denoted as model conditions) represent a maximum-case combination of weather parameters at which a test operation will be permitted to begin. This go/no-go decision is based upon real-time analysis of potential accident impacts, which cannot exceed a facility-established criterion of 170 mrem in any uncontrolled area. This criterion is based on NTS standards for underground nuclear tests; the same values were used at INEL for comparative purposes. Bounding accident-case weather conditions, were selected to represent the significantly deteriorated weather conditions, relative to the model conditions which may be encountered beyond the 10- to 12-hour pre-test forecast window.

Four parameters are used to describe weather conditions at each site: wind speed, plume direction, height of the inversion layer base, and atmospheric stability. The presence of an inversion layer represents a ceiling above which released contaminants cannot rise. This reduces the time required for a release to impact at ground level, and limits the available volume in which contaminants can disperse. Atmospheric stability is the rapidity with which a release will mix and disperse in the air, and is represented by Pasquill stability conditions. These are expressed as conditions ranging from Stability A through Stability F. Stability A represents an extremely turbulent, rapidly mixing atmosphere (minimizing the downwind concentration), while Stability F represents an extremely calm, slowly mixing

atmosphere (maximizing the downwind concentration). Stabilities B through E represent the range of conditions in between. Table E-1 provides a summary of the selected model weather conditions, while Table E-2 provides a summary of the accident-case conditions.

Table E-1. Model Weather Conditions

	NTS	INEL
Pasquill Stability Class	D	D
Wind Speed (m/s)	5.5	5.5
Plume Direction[a]	NNE[b]	NNE[1]
Inversion Base Height (m)	2,000	1,500

(a) Direction to which the wind is blowing
(b) Generally in the northerly direction

Table E-2 Bounding Accident-Case Weather Conditions

	NTS	INEL
Pasquill Stability Category	F	F
Wind Speed (m/s)	1.0	1.0
Plume Direction	Towards the Highest Population	Towards the Highest Population
Inversion Base Height (m)	300	300

Model wind speed, direction, and stability data were selected at NTS based on the results of the nearest National Oceanic and Atmospheric Administration (NOAA)-operated monitoring station (MEDA-14) to the SMTS. Pasquill stability D (neutral stability) was selected even though classes B and C occur more frequently, since class D will result in a more conservative estimate of the impacts. Stability classes E and F occur less frequently at SMTS than do classes A through D; when they exist, they are typically present in the early morning hours only. The average wind speed at the SMTS is 5.5 meters per second (m/s) and was selected as the model wind speed for which analyses at the SMTS are evaluated. The selected model (and measured average) wind direction at the SMTS is toward the north-northeast (NNE).

The model inversion layer chosen at NTS was based on a yearly averaged number. Inversions at NTS occur approximately 40 percent of the time in the spring, 20 percent in the summer, 50 percent in the fall, and 65 percent

of the time in the winter (Quiring, 1973). Inversion layer statistics list a yearly averaged inversion layer base altitude of approximately 2.5 kilometers (the yearly average is computed from the average spring, summer, fall, and winter values). For conservatism, 80 percent of this altitude, or 2.0 kilometers, was selected as the model mixing layer altitude.

Model weather data at the INEL site were taken from weather data obtained by NOAA at INEL (Clawson, 1989). Model stability classes at INEL are similar to NTS, with E and F stability being somewhat more common year-round. However, like NTS, the E and F stabilities are primarily restricted to the early morning hours when they exist. Average wind speeds at ground level at INEL are somewhat slower than at NTS, averaging 3.2 m/s. However measurements at 150 and 250 feet, approximately the height of the ETS effluent stack, are similar to NTS at 5.6 m/s. Wind directions at INEL are more unpredictable than at NTS but at the 150 to 250 foot level are predominantly toward the northeast. For these reasons, a similar stability class D, wind speed 5.5 m/s, and wind direction NNE, was selected at INEL.

At INEL, inversions occur regularly and in general have lower base altitudes than those found at NTS. Inversion statistics at INEL show a yearly average afternoon inversion base of 1.88 kilometers (calculated from seasonal average inversion data). As was determined for the NTS inversion layer, 80 percent of this height is taken as the model inversion layer height (1.5 kilometers).

These weather conditions are based on available data at the sites of interest and represent conservative bounds on weather. It is important to understand that the weather conditions specified are not individual parameter bounds that must be realized before operation can commence. The impacts which may occur as a result of a release would depend upon a combination of all weather-related factors (wind speed, wind direction, atmospheric stability, inversion layer height). Thus, many different combinations of these factors can yield a similar set of resulting impacts. Precise combinations of meteorological conditions that have been selected for use in the analysis are meant to represent one set of conditions that will result in the bounding case impacts. Each individual weather parameter should not be viewed as the minimum/maximum acceptable for operations to commence, but rather as part of a combination of parameters that will determine acceptability for testing. During actual operational testing, real time weather assessments and impact modeling, very similar to those performed before an underground test at NTS (Office of Technology Assessment, 1989), would be performed to determine if accidental releases may produce impacts which exceed acceptable criteria, thus initiating a test hold.

Plume rise was also considered in modeling of release impacts. The higher a release is able to rise (limited by inversion if present), the greater the degree of dispersal and mixing (i.e., lowering the concentrations) prior to ground-level contact where people may directly encounter the material. The height to which a release is able to ascend is based upon such factors as temperature and heat content of the release cloud, and release height (effluent stack as opposed to ground level). For operational releases, the release point would be through the ETS flare stack (for burning of hydrogen).

Plume powers necessary to specify buoyant rise are defined by the energy release from burning hydrogen and the hydrogen flow rate for normal operations. The hydrogen flow rate out the flare stack for typical operations is estimated as 134 kilograms per second (kg/s) for PIPET operations, and 536 kg/s for GTA operations. The energy release from burning 1 kg of hydrogen is given as 121 megajoules per kilogram (MJ/kg) (National Aeronautics and Space Administration, 1968). This results in a plume power of 16.2 gigawatts (GW) (1 GW equals 1 billion watts) for PIPET and 64.9 GW for GTA. A recent investigation (Carney, 1992) shows that for hydrogen flow rates of 10 to 20 kg/s, plume rise in excess of 2 kilometers can be expected, which is in excess of inversion base heights used in this assessment. Since the inversion base is considered to be the maximum possible rise height in this analysis, inversion height is accepted as the final rise height for all assessments of PBR propulsion technology bounding case scenarios. Consideration of plume rise also allows evaluation of a hydrogen fire concurrent with an accidental release. However, for all such cases the accidental lofting produced by the hydrogen is negated by the inversion layer boundary.

1.3 RADIOLOGICAL RELEASES

Radiological consequence assessment is based upon the quantities of various radionuclides which are released to the environment, collectively referred to as the "source term." The source term can vary in magnitude based upon the total quantity of radioactive material present in a PIPET or GTA core (the total inventory), and the fractional amount of each nuclide that is released to the environment during any given operation or accident.

The total inventory present in a PIPET or GTA core consists of three groups:

- Unburned (unfissioned) reactor fuel consisting of 93 percent enriched uranium
- Fission products accumulated during reactor operations as a result of reactor fuel fissioning

- Activation products produced during reactor operations from the interaction of neutrons with core structural materials and coolant, creating radioactive isotopes of the materials (referred to as neutron "activation").

Fission products will account for greater than 99 percent of radiological impacts, with the remainder consisting of activation products. Source terms are calculated using both fission products and activation products.

Fission Product Inventories

The fission product inventory present in a reactor is primarily dependent upon the total operating time and output thermal energies at which the core has been operated, referred to as the "core operational power history." Core operational power history may be expressed in terms of total thermal energy produced in the core, which is the product of operational thermal power in MW times the total operating time in seconds, and is expressed in terms of MW-seconds, or MJ. Since the numbers which result from this calculation are often quite large, it is more common to express the final operational power history in units of terajoules (TJ) (1 TJ equals 1 million MJ) to yield numbers which are less cumbersome.

Increases in the total operational power history increase the fission product inventory in an approximately linear fashion (i.e., a doubling of the total energy produced will approximately double the total fission product inventory). For purposes of this assessment, the following test operation maximum power and duration values for PIPET and GTA are used:

- PIPET: Five operations of 550 MW for 500 seconds each, for a total of 1.375 TJ total energy produced

- GTA: 2,000 MW operational power for 1,000 seconds for a total of 2.0 TJ total energy produced.

Determinations were also made as to the maximum 1-year operational scenario that might be expected. This was determined to be operation of two PIPET cores, each operated for five tests (maximum case tests as expressed above) with a 1-week interval between tests, and two GTA cores, each operated for one maximum case test. One of the 10 PIPETs was assumed to be a Normal III experiment. This scenario does not preclude other annual operational scenarios, as long as the source terms capable of being released in alternative scenarios do not exceed those evaluated as above. Once a PBR propulsion technology reactor core has reached these source term limits, it will be taken out of service.

The radiological inventory resulting from these operational histories was generated using the ORIGEN2 computer program, and consists of fission and activation products generated during reactor operation. ORIGEN2 is a code

specifically developed by Oak Ridge National Laboratories to calculate fission product build-up and inventories in operational reactors. Example core inventories for 639 isotopes resulting from a single maximum case operation of a PIPET and GTA core are listed in Tables E-3 and E-4, respectively.

Source Term Development

Core inventory constituents would originate primarily within the fuel particles, mainly in the uranium kernel. The fuel particles would, therefore, serve as the primary containment. A small quantity of some constituents (such as noble gases and other "volatiles") would be released directly from the fuel particles; additional releases may occur due to failure of a small number of fuel particles. In the event of an accident, a larger amount may be released. Radioactive materials released from the reactor core will enter the ETS, which is designed to contain released core material, allowing only small quantities of material to be released to the environment. The quantities of various nuclides that are actually released to the environment are collectively referred to as the "source term," and can vary in magnitude from a fractional amount of the total core inventory (the case for Normal II operations), to the entire inventory (as for a Consequence I accident).

Of the total isotope inventories for PIPET and GTA, the release fractions for 55 nuclides have been expressly calculated for a Normal II operation (see Section 2.2 for explanation of Normal II) (Young, 1992). Release routes from intact particles were calculated based on literature values of diffusion rates in coated fuel particles. Failed fuel releases were based on experimental measurements assuming 1 percent fuel failure rate. Table E-5 presents specific quantities released for these 55 nuclides, which have been identified as the major contributors to the radiological consequences.

Assumptions have been made to estimate the release fractions of the remaining isotope inventory during a Normal II operation. The majority of these remaining isotopes are largely non-volatile, and in general, have small diffusion release rates, thought to be less than 1 percent in general. A few of the highly mobile isotopes (e.g., cesium and strontium) show higher fractional releases of up to 12 percent. Accordingly, the remaining noble gas, halogen, and non-volatile species are assigned release fractions as shown in Table E-6. These have been determined by combining the inventory isotopes into four groups based upon their chemical similarities. Additionally, all isotope release fractions are incremented an additional 1 percent to conservatively account for unanticipated fuel failures (Young, 1992).

In addition to fuel particle core release fractions, ETS design goal retention efficiencies of 99.9 percent for particulates and 99.5 percent for volatiles, halogens, and nobles are assumed in calculating final release values. These

Table E-3. PIPET Fission and Activation Product Inventory 550 MW, 500 Second Operation
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Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)
^{108}Ag	2.404×10^{3}	^{95}Br	3.394×10^{1}	^{80}Cu	3.243×10^{0}	^{139}I	3.387×10^{6}	^{28}Mg	7.541×10^{-4}
^{108m}Ag	2.228×10^{12}	^{96}Br	1.549×10^{0}	^{81}Cu	1.896×10^{-1}	^{140}I	9.950×10^{5}	^{101}Mo	7.436×10^{6}
^{109m}Ag	6.014×10^{2}	^{14}C	1.147×10^{-8}	^{165}Dy	5.476×10^{-1}	^{141}I	1.420×10^{5}	^{102}Mo	1.391×10^{7}
^{110}Ag	1.189×10^{1}	^{113m}Cd	4.213×10^{-4}	^{165m}Dy	8.805×10^{0}	^{142}I	1.029×10^{4}	^{104}Mo	8.191×10^{6}
^{110m}Ag	3.160×10^{7}	^{115}Cd	3.436×10^{1}	^{166}Dy	1.184×10^{-2}	^{143}I	4.197×10^{2}	^{105}Mo	4.289×10^{6}
^{111}Ag	3.581×10^{0}	^{115m}Cd	4.334×10^{-1}	^{169}Er	1.763×10^{-11}	^{144}I	1.592×10^{1}	^{106}Mo	1.667×10^{6}
^{111m}Ag	1.759×10^{4}	^{117}Cd	1.599×10^{3}	^{150}Eu	1.392×10^{-8}	^{112m}In	9.162×10^{-7}	^{107}Mo	6.240×10^{5}
^{112}Ag	2.984×10^{1}	^{117m}Cd	6.799×10^{2}	^{152}Eu	9.507×10^{-7}	^{114}In	8.215×10^{-5}	^{108}Mo	1.897×10^{4}
^{113}Ag	1.025×10^{2}	^{119}Cd	1.793×10^{4}	^{152m}Eu	4.949×10^{-3}	^{114m}In	6.561×10^{-6}	^{111}Mo	1.767×10^{2}
^{113m}Ag	7.973×10^{3}	^{119m}Cd	3.262×10^{4}	^{154}Eu	1.037×10^{-5}	^{115m}In	3.551×10^{-1}	^{112}Mo	1.962×10^{1}
^{115}Ag	1.166×10^{4}	^{121}Cd	7.936×10^{4}	^{155}Eu	3.819×10^{-2}	^{116}In	9.657×10^{-2}	^{113}Mo	1.278×10^{0}
^{115m}Ag	2.051×10^{4}	^{123}Cd	7.018×10^{4}	^{156}Eu	1.476×10^{-1}	^{116m}In	9.741×10^{-3}	^{115}Mo	3.025×10^{-3}
^{117}Ag	3.707×10^{4}	^{125}Cd	3.661×10^{4}	^{157}Eu	5.731×10^{1}	^{117}In	3.051×10^{1}	^{99}Mo	3.791×10^{4}
^{117m}Ag	3.796×10^{4}	^{126}Cd	3.791×10^{4}	^{158}Eu	2.691×10^{2}	^{117m}In	4.032×10^{1}	^{24}Na	1.054×10^{2}
^{119}Ag	5.863×10^{4}	^{127}Cd	1.892×10^{4}	^{159}Eu	1.134×10^{3}	^{119}In	1.219×10^{4}	^{101}Nb	2.287×10^{7}
^{121}Ag	2.360×10^{4}	^{128}Cd	8.401×10^{3}	^{161}Eu	5.377×10^{2}	^{119m}In	5.880×10^{3}	^{102}Nb	1.018×10^{7}
^{122}Ag	6.021×10^{3}	^{129}Cd	1.421×10^{3}	^{162}Eu	5.999×10^{-1}	^{121}In	6.796×10^{4}	^{104}Nb	3.739×10^{6}
^{123}Ag	6.477×10^{2}	^{130}Cd	3.738×10^{3}	^{72}Ga	3.560×10^{-3}	^{121m}In	1.496×10^{4}	^{105}Nb	9.622×10^{5}
^{124}Ag	2.474×10^{2}	^{131}Cd	3.565×10^{2}	^{73}Ga	2.078×10^{1}	^{123}In	6.882×10^{4}	^{106}Nb	3.336×10^{5}
^{125}Ag	6.441×10^{0}	^{132}Cd	2.846×10^{1}	^{75}Ga	6.636×10^{3}	^{123m}In	3.056×10^{4}	^{107}Nb	5.302×10^{4}
^{28}Al	1.745×10^{6}	^{141}Ce	3.895×10^{0}	^{77}Ga	4.167×10^{4}	^{125}In	6.231×10^{4}	^{108}Nb	1.206×10^{2}
^{29}Al	2.376×10^{10}	^{143}Ce	1.404×10^{4}	^{78}Ga	8.509×10^{4}	^{125m}In	4.767×10^{4}	^{111}Nb	1.397×10^{-1}
^{76}As	2.793×10^{3}	^{144}Ce	3.029×10^{2}	^{79}Ga	7.757×10^{4}	^{126}In	2.217×10^{5}	^{92m}Nb	3.481×10^{-9}
^{77}As	6.214×10^{1}	^{145}Ce	1.401×10^{7}	^{80}Ga	1.015×10^{5}	^{127}In	1.241×10^{5}	^{94}Nb	1.459×10^{-9}
^{78}As	2.504×10^{2}	^{147}Ce	1.003×10^{7}	^{81}Ga	5.399×10^{4}	^{127m}In	1.246×10^{5}	^{94m}Nb	1.214×10^{0}
^{79}As	1.036×10^{5}	^{148}Ce	3.594×10^{6}	^{83}Ga	4.397×10^{3}	^{128}In	2.938×10^{5}	^{95}Nb	2.525×10^{-2}
^{81}As	9.410×10^{5}	^{151}Ce	3.530×10^{5}	^{84}Ga	2.533×10^{2}	^{129}In	1.629×10^{5}	^{95m}Nb	6.605×10^{-1}
^{83}As	1.942×10^{6}	^{152}Ce	6.059×10^{3}	^{159}Gd	7.512×10^{-10}	^{130}In	3.416×10^{5}	^{96}Nb	1.117×10^{1}
^{84}As	1.460×10^{6}	^{155}Ce	1.572×10^{1}	^{160}Gd	2.837×10^{0}	^{131}In	1.127×10^{5}	^{97}Nb	1.234×10^{4}
^{85}As	9.544×10^{5}	^{156}Ce	4.262×10^{-1}	^{161}Gd	4.622×10^{2}	^{132}In	3.052×10^{4}	^{97m}Nb	1.512×10^{5}
^{86}As	5.261×10^{5}	^{157}Ce	1.186×10^{-2}	^{162}Gd	1.045×10^{1}	^{133}In	1.824×10^{3}	^{98}Nb	2.679×10^{7}
^{87}As	2.971×10^{5}	^{72}Co	4.126×10^{0}	^{75}Ge	3.256×10^{2}	^{134}In	3.247×10^{1}	^{98m}Nb	1.328×10^{4}
^{88}As	1.212×10^{4}	^{73}Co	4.326×10^{-1}	^{75m}Ge	2.749×10^{2}	^{81}Kr	4.126×10^{-13}	^{99}Nb	2.689×10^{7}
^{89}As	9.538×10^{2}	^{75}Co	4.463×10^{-2}	^{77}Ge	1.240×10^{2}	^{81m}Kr	4.106×10^{-3}	^{99m}Nb	6.112×10^{6}
^{137m}Ba	4.639×10^{3}	^{132}Cs	5.382×10^{-8}	^{77m}Ge	3.738×10^{4}	^{83m}Kr	1.132×10^{3}	^{147}Nd	4.912×10^{2}
^{139}Ba	4.817×10^{6}	^{134}Cs	3.492×10^{-4}	^{78}Ge	5.980×10^{3}	^{85}Kr	2.156×10^{-2}	^{149}Nd	1.742×10^{5}
^{140}Ba	7.273×10^{3}	^{134m}Cs	4.087×10^{0}	^{79}Ge	2.007×10^{5}	^{85m}Kr	6.619×10^{4}	^{151}Nd	7.130×10^{5}
^{141}Ba	6.933×10^{6}	^{135}Cs	2.153×10^{-8}	^{81}Ge	6.659×10^{5}	^{87}Kr	7.465×10^{5}	^{153}Nd	6.811×10^{5}
^{142}Ba	1.107×10^{7}	^{135m}Cs	2.970×10^{2}	^{83}Ge	4.525×10^{5}	^{88}Kr	5.405×10^{5}	^{154}Nd	8.236×10^{4}
^{143}Ba	2.433×10^{7}	^{136}Cs	1.023×10^{1}	^{84}Ge	8.819×10^{4}	^{89}Kr	1.773×10^{7}	^{155}Nd	1.633×10^{4}
^{144}Ba	1.954×10^{7}	^{137}Cs	4.914×10^{0}	^{85}Ge	2.964×10^{4}	^{90}Kr	2.115×10^{7}	^{157}Nd	2.762×10^{3}
^{145}Ba	9.151×10^{6}	^{138}Cs	1.172×10^{6}	^{86}Ge	5.248×10^{3}	^{91}Kr	1.560×10^{7}	^{158}Nd	3.096×10^{2}
^{147}Ba	6.011×10^{5}	^{138m}Cs	9.854×10^{5}	^{87}Ge	8.422×10^{2}	^{92}Kr	6.828×10^{6}	^{159}Nd	1.454×10^{1}
^{148}Ba	4.284×10^{3}	^{139}Cs	1.227×10^{7}	^{88}Ge	9.604×10^{0}	^{93}Kr	2.322×10^{6}	^{161}Nd	1.198×10^{-2}
^{10}Be	5.759×10^{6}	^{140}Cs	2.584×10^{7}	^{3}H	6.429×10^{-2}	^{94}Kr	1.046×10^{6}	^{72}Ni	1.359×10^{2}
^{80}Br	4.969×10^{1}	^{141}Cs	2.033×10^{7}	^{166}Ho	7.423×10^{-5}	^{95}Kr	4.706×10^{4}	^{73}Ni	6.965×10^{1}
^{80m}Br	2.836×10^{2}	^{142}Cs	1.307×10^{7}	^{166m}Ho	1.253×10^{-10}	^{96}Kr	7.699×10^{3}	^{75}Ni	4.592×10^{1}
^{82}Br	1.060×10^{0}	^{143}Cs	7.000×10^{6}	^{128}I	1.121×10^{1}	^{97}Kr	1.879×10^{2}	^{77}Ni	2.061×10^{0}
^{82m}Br	2.055×10^{2}	^{144}Cs	1.462×10^{6}	^{129}I	2.749×10^{0}	^{98}Kr	1.965×10^{1}	^{78}Ni	2.335×10^{1}
^{83}Br	5.197×10^{4}	^{145}Cs	3.312×10^{5}	^{130}I	6.466×10^{0}	^{140}La	7.400×10^{1}	^{236m}Np	3.141×10^{11}
^{84}Br	4.218×10^{5}	^{146}Cs	3.738×10^{4}	^{130m}I	1.715×10^{2}	^{141}La	9.079×10^{4}	^{237}Np	1.184×10^{-11}
^{85}Br	4.635×10^{6}	^{147}Cs	2.730×10^{3}	^{131}I	7.985×10^{1}	^{142}La	3.956×10^{5}	^{238}Np	5.801×10^{-7}
^{87}Br	9.864×10^{6}	^{66}Cu	1.587×10^{-3}	^{132}I	4.193×10^{3}	^{143}La	8.776×10^{6}	^{239}Np	1.279×10^{2}
^{88}Br	1.150×10^{7}	^{67}Cu	2.205×10^{-10}	^{133}I	1.919×10^{4}	^{144}La	2.465×10^{7}	^{240}Np	3.459×10^{-1}
^{89}Br	8.686×10^{6}	^{72}Cu	2.909×10^{2}	^{133m}I	5.934×10^{5}	^{145}La	1.693×10^{7}	^{240m}Np	6.718×10^{-1}
^{90}Br	5.852×10^{6}	^{73}Cu	5.243×10^{2}	^{134}I	5.406×10^{5}	^{147}La	4.912×10^{6}	^{241}Np	1.311×10^{-5}
^{91}Br	1.814×10^{6}	^{75}Cu	1.294×10^{3}	^{134m}I	1.643×10^{6}	^{148}La	3.274×10^{5}	^{232}Pa	2.029×10^{-11}
^{92}Br	8.728×10^{4}	^{77}Cu	5.409×10^{2}	^{135}I	4.056×10^{5}	^{151}La	4.130×10^{3}	^{234}Pa	1.587×10^{-10}
^{93}Br	2.168×10^{4}	^{78}Cu	2.051×10^{2}	^{137}I	1.500×10^{7}	^{153}La	6.949×10^{0}	^{107}Pd	5.677×10^{-8}
^{94}Br	1.506×10^{3}	^{79}Cu	2.392×10^{1}	^{138}I	7.625×10^{6}	^{27}Mg	3.598×10^{4}	^{107m}Pd	3.554×10^{-3}

Table E-3. PIPET Fission and Activation Product Inventory 550 MW, 500 Second Operation
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Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)
^{109}Pd	6.017×10^{3}	^{94}Rb	8.131×10^{6}	^{139}Sb	2.741×10^{1}	^{94}Sr	2.675×10^{7}	^{133}Xe	3.105×10^{6}
^{109m}Pd	5.029×10^{4}	^{95}Rb	4.169×10^{6}	^{79}Se	3.583×10^{-6}	^{95}Sr	2.502×10^{7}	^{133m}Xe	3.580×10^{1}
^{111}Pd	2.242×10^{4}	^{96}Rb	9.282×10^{5}	^{79m}Se	5.367×10^{4}	^{97}Sr	8.880×10^{6}	^{135}Xe	2.727×10^{3}
^{111m}Pd	1.659×10^{1}	^{97}Rb	1.677×10^{5}	^{81}Se	2.270×10^{5}	^{98}Sr	3.231×10^{6}	^{135m}Xe	2.566×10^{5}
^{112}Pd	4.101×10^{2}	^{98}Rb	2.426×10^{4}	^{81m}Se	3.022×10^{3}	^{99}Sr	7.102×10^{5}	^{137}Xe	2.068×10^{7}
^{113}Pd	8.275×10^{4}	^{99}Rb	1.872×10^{3}	^{83}Se	2.027×10^{5}	^{160}Tb	2.463×10^{-5}	^{138}Xe	9.581×10^{6}
^{115}Pd	6.992×10^{4}	^{103m}Rh	5.060×10^{1}	^{83m}Se	1.477×10^{6}	^{161}Tb	1.695×10^{-1}	^{139}Xe	2.338×10^{7}
^{117}Pd	7.283×10^{4}	^{104}Rh	3.067×10^{-1}	^{84}Se	3.760×10^{6}	^{165}Tb	1.813×10^{1}	^{140}Xe	1.634×10^{7}
^{119}Pd	1.593×10^{4}	^{104m}Rh	1.291×10^{-1}	^{85}Se	2.900×10^{6}	^{101}Tc	1.408×10^{6}	^{141}Xe	5.416×10^{6}
^{121}Pd	1.379×10^{3}	^{105}Rh	8.359×10^{1}	^{85m}Se	2.116×10^{6}	^{103}Tc	1.399×10^{7}	^{142}Xe	1.759×10^{6}
^{123}Pd	7.330×10^{1}	^{105m}Rh	6.473×10^{3}	^{87}Se	4.502×10^{6}	^{104}Tc	1.793×10^{6}	^{143}Xe	2.398×10^{5}
^{125}Pd	1.800×10^{-1}	^{106m}Rh	4.049×10^{0}	^{88}Se	1.646×10^{6}	^{105}Tc	2.175×10^{6}	^{144}Xe	3.029×10^{4}
^{146}Pm	2.875×10^{-12}	^{107}Rh	8.891×10^{4}	^{89}Se	4.276×10^{5}	^{106}Tc	1.917×10^{6}	^{145}Xe	6.890×10^{2}
^{147}Pm	6.232×10^{-4}	^{108}Rh	1.823×10^{5}	^{90}Se	1.482×10^{5}	^{107}Tc	8.719×10^{5}	^{146}Xe	6.403×10^{1}
^{148}Pm	1.740×10^{-2}	^{108m}Rh	1.028×10^{5}	^{91}Se	1.483×10^{4}	^{108}Tc	1.157×10^{5}	^{147}Xe	1.127×10^{0}
^{148m}Pm	3.265×10^{-4}	^{111}Rh	1.157×10^{5}	^{92}Se	2.206×10^{2}	^{111}Tc	1.180×10^{4}	^{101}Y	1.252×10^{6}
^{149}Pm	1.251×10^{2}	^{112}Rh	8.288×10^{4}	^{151}Sm	5.861×10^{-5}	^{112}Tc	2.492×10^{3}	^{103}Y	2.463×10^{4}
^{150}Pm	8.308×10^{1}	^{113}Rh	7.103×10^{4}	^{153}Sm	4.521×10^{2}	^{113}Tc	5.443×10^{2}	^{104}Y	1.173×10^{3}
^{151}Pm	1.328×10^{3}	^{115}Rh	2.645×10^{4}	^{155}Sm	3.300×10^{4}	^{115}Tc	6.846×10^{0}	^{105}Y	1.037×10^{2}
^{153}Pm	4.392×10^{5}	^{117}Rh	2.793×10^{4}	^{156}Sm	6.584×10^{2}	^{117}Tc	5.325×10^{-2}	^{107}Y	1.721×10^{-1}
^{155}Pm	1.546×10^{5}	^{119}Rh	1.989×10^{2}	^{157}Sm	1.650×10^{4}	^{99}Tc	1.357×10^{-7}	^{90}Y	1.980×10^{1}
^{156}Pm	5.334×10^{4}	^{121}Rh	2.497×10^{0}	^{158}Sm	2.083×10^{3}	^{99m}Tc	2.632×10^{2}	^{90m}Y	1.745×10^{0}
^{157}Pm	1.860×10^{4}	^{123}Rh	2.393×10^{-2}	^{159}Sm	4.264×10^{3}	^{123m}Te	2.283×10^{-8}	^{91}Y	3.157×10^{0}
^{158}Pm	5.102×10^{3}	^{103}Ru	1.174×10^{3}	^{161}Sm	1.911×10^{2}	^{125m}Te	4.454×10^{-5}	^{91m}Y	6.524×10^{3}
^{159}Pm	6.755×10^{2}	^{105}Ru	2.310×10^{4}	^{165}Sm	5.153×10^{-3}	^{127}Te	3.123×10^{0}	^{92}Y	1.412×10^{4}
^{161}Pm	3.845×10^{0}	^{106}Ru	1.824×10^{1}	^{117m}Sn	9.030×10^{-6}	^{127m}Te	1.544×10^{-2}	^{93}Y	8.773×10^{4}
^{142}Pr	8.272×10^{-4}	^{107}Ru	6.013×10^{5}	^{119m}Sn	3.797×10^{-2}	^{129}Te	6.599×10^{3}	^{94}Y	6.085×10^{6}
^{142m}Pr	4.586×10^{-2}	^{108}Ru	2.027×10^{5}	^{121}Sn	2.494×10^{2}	^{129m}Te	6.852×10^{0}	^{95}Y	1.164×10^{7}
^{143}Pr	1.452×10^{0}	^{111}Ru	9.482×10^{4}	^{121m}Sn	8.076×10^{-9}	^{131}Te	3.564×10^{5}	^{97}Y	2.324×10^{7}
^{144}Pr	1.680×10^{2}	^{112}Ru	4.821×10^{4}	^{123}Sn	7.373×10^{-1}	^{131m}Te	3.067×10^{3}	^{98}Y	1.665×10^{7}
^{144m}Pr	8.681×10^{1}	^{113}Ru	2.608×10^{4}	^{123m}Sn	1.038×10^{4}	^{132}Te	1.673×10^{4}	^{99}Y	9.268×10^{6}
^{145}Pr	1.461×10^{5}	^{115}Ru	2.252×10^{3}	^{125}Sn	2.957×10^{1}	^{133}Te	4.746×10^{6}	^{72}Zn	6.538×10^{-1}
^{147}Pr	3.006×10^{6}	^{117}Ru	2.210×10^{2}	^{125m}Sn	4.970×10^{4}	^{133m}Te	1.326×10^{6}	^{73}Zn	1.113×10^{3}
^{149}Pr	4.513×10^{6}	^{122}Sb	4.626×10^{-4}	^{126}Sn	3.643×10^{-5}	^{134}Te	3.984×10^{6}	^{75}Zn	6.311×10^{3}
^{151}Pr	1.384×10^{6}	^{122m}Sb	1.623×10^{-1}	^{127}Sn	2.092×10^{4}	^{135}Te	1.514×10^{7}	^{77}Zn	1.720×10^{4}
^{153}Pr	1.502×10^{5}	^{124}Sb	3.353×10^{-3}	^{127m}Sn	1.747×10^{5}	^{136}Te	8.650×10^{6}	^{78}Zn	1.976×10^{4}
^{155}Pr	3.175×10^{3}	^{124}Sb	3.008×10^{1}	^{128}Sn	1.588×10^{5}	^{137}Te	1.943×10^{6}	^{79}Zn	1.976×10^{4}
^{156}Pr	2.370×10^{2}	^{125}Sb	1.107×10^{2}	^{129}Sn	5.539×10^{5}	^{138}Te	4.022×10^{5}	^{79}Zn	7.623×10^{3}
^{157}Pr	1.485×10^{1}	^{126}Sb	1.433×10^{0}	^{129m}Sn	1.453×10^{6}	^{139}Te	5.994×10^{4}	^{81}Zn	6.082×10^{2}
^{158}Pr	5.958×10^{-1}	^{126m}Sb	6.056×10^{2}	^{131}Sn	4.497×10^{6}	^{140}Te	5.583×10^{3}	^{83}Zn	4.705×10^{0}
^{159}Pr	9.899×10^{-3}	^{127}Sb	1.583×10^{2}	^{132}Sn	2.727×10^{6}	^{141}Te	1.936×10^{2}	^{101}Zr	1.597×10^{7}
^{239}Pu	1.984×10^{-8}	^{128}Sb	7.827×10^{2}	^{133}Sn	7.797×10^{5}	^{142}Te	3.802×10^{0}	^{103}Zr	2.446×10^{6}
^{240}Pu	4.604×10^{-10}	^{129}Sb	4.022×10^{4}	^{134}Sn	5.490×10^{4}	^{231}Th	4.297×10^{-5}	^{104}Zr	3.701×10^{5}
^{241}Pu	1.115×10^{-10}	^{130}Sb	1.349×10^{5}	^{135}Sn	5.721×10^{3}	^{233}Th	8.292×10^{-11}	^{105}Zr	4.755×10^{4}
^{86}Rb	6.876×10^{-2}	^{131}Sb	2.461×10^{6}	^{136}Sn	2.516×10^{2}	^{234}Th	2.225×10^{-8}	^{106}Zr	1.141×10^{4}
^{86m}Rb	2.531×10^{2}	^{132}Sb	6.445×10^{6}	^{101}Sr	1.364×10^{4}	^{233}U	8.074×10^{-10}	^{107}Zr	5.478×10^{2}
^{87}Rb	8.196×10^{-11}	^{132m}Sb	3.679×10^{6}	^{103}Sr	2.217×10^{1}	^{234}U	1.217×10^{-8}	^{108}Zr	8.323×10^{-2}
^{88}Rb	1.202×10^{6}	^{133}Sb	9.416×10^{6}	^{104}Sr	3.826×10^{-1}	^{235}U	1.141×10^{-2}	^{93}Zr	2.351×10^{-7}
^{89}Rb	4.023×10^{6}	^{134}Sb	1.242×10^{6}	^{87m}Sr	1.523×10^{-1}	^{236}U	4.841×10^{-5}	^{95}Zr	4.066×10^{2}
^{90}Rb	1.796×10^{7}	^{134m}Sb	1.187×10^{6}	^{89}Sr	1.291×10^{2}	^{237}U	5.693×10^{0}	^{97}Zr	1.528×10^{5}
^{90m}Rb	3.183×10^{6}	^{135}Sb	9.078×10^{5}	^{90}Sr	5.307×10^{0}	^{238}U	1.337×10^{-4}	^{98}Zr	2.658×10^{7}
^{91}Rb	2.541×10^{7}	^{136}Sb	1.379×10^{5}	^{91}Sr	2.247×10^{5}	^{239}U	1.444×10^{5}	^{99}Zr	2.626×10^{7}
^{92}Rb	2.189×10^{7}	^{137}Sb	9.832×10^{3}	^{92}Sr	9.517×10^{5}	^{240}U	1.067×10^{-1}		
^{93}Rb	1.623×10^{7}	^{138}Sb	6.124×10^{2}	^{93}Sr	1.559×10^{7}	^{241}U	1.170×10^{-4}		

Table E-4. GTA Fission and Activation Product Inventory 2 GW, 1,000 Second Operation

Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)
^{108}Ag	1.098×10^{-4}	^{95}Br	1.234×10^{2}	^{80}Cu	1.179×10^{1}	^{139}I	1.231×10^{7}	^{28}Mg	6.328×10^{-5}
^{108m}Ag	1.620×10^{-11}	^{96}Br	5.631×10^{0}	^{81}Cu	6.166×10^{-1}	^{140}I	3.618×10^{6}	^{101}Mo	4.586×10^{7}
^{109m}Ag	6.435×10^{3}	^{14}C	8.341×10^{-6}	^{165}Dy	4.522×10^{0}	^{141}I	5.162×10^{5}	^{102}Mo	5.243×10^{7}
^{110}Ag	2.108×10^{0}	^{113m}Cd	3.591×10^{-3}	^{165m}Dy	3.573×10^{1}	^{142}I	3.741×10^{4}	^{104}Mo	3.066×10^{7}
^{110m}Ag	3.254×10^{-4}	^{115}Cd	3.400×10^{2}	^{166}Dy	8.655×10^{-3}	^{143}I	1.526×10^{3}	^{105}Mo	1.564×10^{7}
^{111}Ag	8.655×10^{1}	^{115m}Cd	3.513×10^{0}	^{169}Er	2.427×10^{-10}	^{144}I	5.789×10^{1}	^{106}Mo	6.135×10^{6}
^{111m}Ag	1.586×10^{5}	^{117}Cd	1.165×10^{4}	^{150}Eu	1.387×10^{-7}	^{113m}In	6.476×10^{-6}	^{107}Mo	2.269×10^{6}
^{112}Ag	2.602×10^{2}	^{117m}Cd	5.095×10^{3}	^{152}Eu	9.462×10^{-6}	^{114}In	3.013×10^{-4}	^{108}Mo	6.898×10^{4}
^{113}Ag	8.618×10^{3}	^{119}Cd	1.011×10^{5}	^{152m}Eu	4.886×10^{-2}	^{114m}In	4.772×10^{-6}	^{111}Mo	6.423×10^{2}
^{113m}Ag	3.113×10^{4}	^{119m}Cd	1.391×10^{5}	^{154}Eu	7.782×10^{-5}	^{115m}In	6.401×10^{0}	^{112}Mo	7.132×10^{1}
^{115}Ag	8.016×10^{4}	^{121}Cd	2.885×10^{5}	^{155}Eu	5.609×10^{-1}	^{116}In	3.562×10^{-1}	^{113}Mo	4.649×10^{0}
^{115m}Ag	7.456×10^{4}	^{123}Cd	2.552×10^{5}	^{156}Eu	1.855×10^{0}	^{116m}In	6.749×10^{-2}	^{115}Mo	1.100×10^{-2}
^{117}Ag	1.380×10^{5}	^{125}Cd	1.331×10^{5}	^{157}Eu	7.431×10^{2}	^{117}In	4.753×10^{2}	^{99}Mo	2.838×10^{5}
^{117m}Ag	1.380×10^{5}	^{126}Cd	1.378×10^{5}	^{158}Eu	2.686×10^{3}	^{117m}In	6.445×10^{2}	^{24}Na	7.640×10^{2}
^{119}Ag	2.132×10^{5}	^{127}Cd	6.879×10^{4}	^{159}Eu	8.784×10^{3}	^{119}In	6.718×10^{4}	^{101}Nb	8.317×10^{7}
^{121}Ag	8.580×10^{4}	^{128}Cd	3.055×10^{4}	^{161}Eu	1.955×10^{3}	^{119m}In	5.764×10^{4}	^{102}Nb	3.699×10^{7}
^{123}Ag	2.189×10^{4}	^{129}Cd	5.167×10^{3}	^{162}Eu	2.181×10^{0}	^{121}In	2.471×10^{5}	^{104}Nb	1.359×10^{7}
^{125}Ag	2.356×10^{3}	^{130}Cd	1.359×10^{4}	^{72}Ga	4.220×10^{-2}	^{121m}In	6.493×10^{4}	^{105}Nb	3.571×10^{6}
^{126}Ag	8.993×10^{2}	^{131}Cd	1.296×10^{3}	^{73}Ga	1.554×10^{2}	^{123}In	2.502×10^{5}	^{106}Nb	1.213×10^{6}
^{128}Ag	2.342×10^{1}	^{132}Cd	1.035×10^{2}	^{76}Ga	2.558×10^{4}	^{123m}In	1.111×10^{5}	^{107}Nb	1.928×10^{5}
^{28}Al	6.827×10^{6}	^{141}Ce	1.056×10^{2}	^{77}Ga	1.515×10^{5}	^{125}In	2.265×10^{5}	^{108}Nb	4.387×10^{2}
^{29}Al	3.982×10^{-8}	^{143}Ce	1.826×10^{5}	^{78}Ga	3.094×10^{5}	^{125m}In	1.733×10^{5}	^{111}Nb	5.061×10^{-1}
^{76}As	2.036×10^{-2}	^{144}Ce	2.381×10^{3}	^{79}Ga	2.820×10^{5}	^{126}In	8.060×10^{5}	^{92m}Nb	2.532×10^{-7}
^{77}As	5.028×10^{2}	^{145}Ce	6.120×10^{7}	^{80}Ga	3.690×10^{5}	^{127}In	4.514×10^{5}	^{94}Nb	1.217×10^{-8}
^{78}As	3.082×10^{3}	^{147}Ce	3.726×10^{7}	^{81}Ga	1.963×10^{5}	^{127m}In	4.530×10^{5}	^{94m}Nb	6.170×10^{0}
^{79}As	6.080×10^{5}	^{148}Ce	1.307×10^{7}	^{83}Ga	1.599×10^{4}	^{128}In	1.068×10^{6}	^{95}Nb	4.915×10^{-1}
^{81}As	3.421×10^{6}	^{151}Ce	1.284×10^{6}	^{84}Ga	9.208×10^{2}	^{129}In	6.651×10^{5}	^{95m}Nb	4.822×10^{0}
^{82}As	7.059×10^{6}	^{153}Ce	2.203×10^{4}	^{153}Gd	5.688×10^{-6}	^{130}In	1.242×10^{6}	^{96}Nb	8.107×10^{1}
^{84}As	5.308×10^{6}	^{155}Ce	5.715×10^{1}	^{159}Gd	4.507×10^{1}	^{131}In	4.098×10^{5}	^{97}Nb	1.348×10^{5}
^{85}As	3.470×10^{6}	^{156}Ce	1.550×10^{0}	^{161}Gd	2.157×10^{3}	^{132}In	1.110×10^{5}	^{97m}Nb	1.166×10^{6}
^{86}As	1.909×10^{6}	^{157}Ce	4.308×10^{-2}	^{162}Gd	3.926×10^{1}	^{133}In	6.630×10^{3}	^{98}Nb	9.739×10^{7}
^{87}As	1.080×10^{6}	^{72}Co	1.500×10^{1}	^{75}Ge	2.827×10^{3}	^{134}In	1.181×10^{2}	^{98m}Nb	9.145×10^{4}
^{88}As	4.406×10^{4}	^{73}Co	1.573×10^{0}	^{75m}Ge	1.058×10^{3}	^{81}Kr	3.032×10^{-12}	^{99}Nb	9.776×10^{7}
^{89}As	3.468×10^{3}	^{75}Co	1.623×10^{-1}	^{77}Ge	9.492×10^{2}	^{81m}Kr	1.494×10^{-2}	^{99m}Nb	2.463×10^{6}
^{135m}Ba	3.368×10^{-2}	^{132}Cs	5.413×10^{-6}	^{77m}Ge	1.413×10^{5}	^{83m}Kr	2.194×10^{4}	^{147}Nd	8.173×10^{3}
^{139}Ba	5.902×10^{6}	^{134}Cs	2.618×10^{-3}	^{78}Ge	4.240×10^{4}	^{85}Kr	2.497×10^{-1}	^{149}Nd	1.556×10^{6}
^{140}Ba	5.889×10^{4}	^{134m}Cs	2.924×10^{1}	^{79}Ge	7.297×10^{5}	^{85m}Kr	6.555×10^{5}	^{151}Nd	4.239×10^{6}
^{141}Ba	4.486×10^{7}	^{135}Cs	2.101×10^{-7}	^{81}Ge	2.421×10^{6}	^{87}Kr	5.628×10^{6}	^{152}Nd	2.503×10^{6}
^{142}Ba	6.380×10^{7}	^{136m}Cs	2.048×10^{3}	^{83}Ge	1.645×10^{6}	^{88}Kr	3.930×10^{6}	^{154}Nd	2.994×10^{5}
^{143}Ba	8.844×10^{7}	^{136}Cs	7.438×10^{1}	^{84}Ge	3.207×10^{5}	^{89}Kr	7.506×10^{7}	^{156}Nd	5.953×10^{4}
^{144}Ba	7.104×10^{7}	^{137}Cs	5.090×10^{1}	^{85}Ge	1.078×10^{5}	^{90}Kr	7.689×10^{7}	^{157}Nd	1.004×10^{4}
^{145}Ba	3.327×10^{7}	^{138}Cs	1.271×10^{7}	^{86}Ge	1.908×10^{4}	^{91}Kr	5.673×10^{7}	^{158}Nd	1.126×10^{3}
^{147}Ba	2.186×10^{6}	^{138m}Cs	4.071×10^{6}	^{87}Ge	3.062×10^{3}	^{92}Kr	2.482×10^{7}	^{159}Nd	5.286×10^{1}
^{148}Ba	1.558×10^{4}	^{139}Cs	7.220×10^{7}	^{88}Ge	3.492×10^{1}	^{93}Kr	8.444×10^{6}	^{161}Nd	4.358×10^{2}
^{10}Be	4.189×10^{-5}	^{140}Cs	9.670×10^{7}	^{3}H	5.204×10^{-1}	^{94}Kr	3.803×10^{6}	^{72}Ni	4.941×10^{2}
^{80}Br	3.132×10^{0}	^{141}Cs	7.391×10^{7}	^{166}Ho	6.969×10^{-4}	^{95}Kr	1.711×10^{5}	^{73}Ni	2.533×10^{2}
^{80m}Br	2.040×10^{-1}	^{142}Cs	4.752×10^{7}	^{166m}Ho	9.116×10^{-10}	^{96}Kr	2.799×10^{4}	^{76}Ni	1.670×10^{2}
^{82}Br	9.024×10^{0}	^{143}Cs	2.545×10^{7}	^{128}I	7.310×10^{1}	^{97}Kr	6.832×10^{2}	^{77}Ni	7.567×10^{0}
^{82m}Br	1.045×10^{3}	^{144}Cs	5.314×10^{6}	^{129}I	4.057×10^{-6}	^{98}Kr	7.145×10^{1}	^{78}Ni	8.491×10^{-1}
^{83}Br	4.433×10^{5}	^{145}Cs	1.204×10^{6}	^{130}I	4.981×10^{1}	^{140}La	6.235×10^{2}	^{236m}Np	7.221×10^{-10}
^{84}Br	3.869×10^{6}	^{146}Cs	1.369×10^{5}	^{130m}I	9.523×10^{2}	^{141}La	1.209×10^{6}	^{237}Np	2.025×10^{-10}
^{85}Br	1.989×10^{7}	^{147}Cs	9.924×10^{3}	^{131}I	1.655×10^{3}	^{142}La	4.671×10^{6}	^{238}Np	1.334×10^{-4}
^{87}Br	3.627×10^{7}	^{66}Cu	7.632×10^{-3}	^{132}I	3.296×10^{4}	^{143}La	5.436×10^{7}	^{239}Np	1.722×10^{3}
^{88}Br	4.182×10^{7}	^{67}Cu	1.660×10^{-6}	^{133}I	2.379×10^{5}	^{144}La	8.960×10^{7}	^{240}Np	6.365×10^{6}
^{89}Br	3.158×10^{7}	^{72}Cu	1.058×10^{3}	^{133m}I	2.158×10^{6}	^{145}La	6.154×10^{7}	^{240m}Np	1.070×10^{1}
^{90}Br	2.128×10^{7}	^{73}Cu	1.906×10^{3}	^{134}I	5.441×10^{6}	^{147}La	1.786×10^{7}	^{241}Np	1.562×10^{-4}
^{91}Br	6.594×10^{6}	^{75}Cu	4.706×10^{3}	^{134m}I	7.229×10^{6}	^{148}La	1.191×10^{6}	^{232}Pa	5.893×10^{-10}
^{92}Br	3.173×10^{5}	^{77}Cu	1.967×10^{3}	^{135}I	2.973×10^{6}	^{151}La	1.501×10^{4}	^{234}Pa	3.337×10^{-6}
^{93}Br	7.884×10^{4}	^{78}Cu	7.459×10^{2}	^{137}I	5.453×10^{7}	^{153}La	2.527×10^{1}	^{107}Pd	1.252×10^{-6}
^{94}Br	5.476×10^{3}	^{79}Cu	8.698×10^{1}	^{138}I	2.772×10^{7}	^{27}Mg	2.019×10^{5}	^{107m}Pd	1.305×10^{-2}

Table E-4. GTA Fission and Activation Product Inventory 2 GW, 1,000 Second Operation

Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)	Isotope	Inventory (Curies)
^{109}Pd	6.438×10^{3}	^{94}Rb	2.956×10^{7}	^{139}Sb	9.965×10^{1}	^{94}Sr	9.844×10^{7}	^{133}Xe	2.274×10^{1}
^{109m}Pd	2.544×10^{5}	^{95}Rb	1.516×10^{7}	^{79}Se	7.153×10^{-6}	^{95}Sr	9.095×10^{7}	^{133m}Xe	4.802×10^{2}
^{111}Pd	1.597×10^{5}	^{96}Rb	3.375×10^{6}	^{79m}Se	4.637×10^{6}	^{97}Sr	3.229×10^{7}	^{135}Xe	2.258×10^{4}
^{111m}Pd	1.257×10^{2}	^{97}Rb	6.099×10^{5}	^{81}Se	1.522×10^{6}	^{98}Sr	1.176×10^{7}	^{135m}Xe	1.645×10^{6}
^{112}Pd	2.996×10^{3}	^{98}Rb	8.820×10^{4}	^{81m}Se	2.093×10^{4}	^{99}Sr	2.582×10^{6}	^{137}Xe	9.362×10^{7}
^{113}Pd	3.088×10^{5}	^{99}Rb	6.807×10^{3}	^{83}Se	1.328×10^{6}	^{160}Tb	1.792×10^{-4}	^{138}Xe	5.816×10^{7}
^{115}Pd	2.542×10^{5}	^{103m}Rh	8.560×10^{2}	^{83m}Se	5.588×10^{6}	^{161}Tb	1.831×10^{0}	^{139}Xe	8.500×10^{7}
^{117}Pd	2.648×10^{5}	^{104}Rh	1.421×10^{0}	^{84}Se	1.609×10^{7}	^{163}Tb	6.718×10^{1}	^{140}Xe	5.939×10^{7}
^{119}Pd	5.793×10^{4}	^{104m}Rh	5.996×10^{-1}	^{85}Se	1.054×10^{7}	^{101}Tc	1.611×10^{7}	^{141}Xe	1.969×10^{7}
^{121}Pd	5.015×10^{3}	^{105}Rh	1.104×10^{3}	^{85m}Se	7.694×10^{6}	^{102}Tc	5.273×10^{7}	^{142}Xe	6.396×10^{6}
^{123}Pd	2.665×10^{2}	^{105m}Rh	9.076×10^{4}	^{87}Se	1.637×10^{7}	^{104}Tc	1.286×10^{7}	^{143}Xe	8.719×10^{5}
^{125}Pd	6.544×10^{-1}	^{106m}Rh	5.996×10^{1}	^{88}Se	5.983×10^{6}	^{105}Tc	1.225×10^{7}	^{144}Xe	1.101×10^{5}
^{146}Pm	1.757×10^{-10}	^{107}Rh	8.847×10^{5}	^{89}Se	1.555×10^{6}	^{106}Tc	6.969×10^{6}	^{145}Xe	2.505×10^{3}
^{147}Pm	2.439×10^{-2}	^{108}Rh	7.482×10^{5}	^{90}Se	5.387×10^{5}	^{107}Tc	3.170×10^{6}	^{146}Xe	2.328×10^{2}
^{148}Pm	1.273×10^{-1}	^{109}Rh	3.741×10^{5}	^{91}Se	5.390×10^{4}	^{108}Tc	4.212×10^{5}	^{147}Xe	4.096×10^{0}
^{148m}Pm	2.435×10^{-3}	^{111}Rh	4.378×10^{5}	^{92}Se	8.022×10^{2}	^{111}Tc	4.291×10^{4}	^{101}Y	4.551×10^{6}
^{149}Pm	2.436×10^{3}	^{112}Rh	3.013×10^{5}	^{151}Sm	1.478×10^{-3}	^{112}Tc	9.059×10^{3}	^{102}Y	8.954×10^{4}
^{150}Pm	6.196×10^{2}	^{113}Rh	2.582×10^{5}	^{153}Sm	6 '43 $\times 10^{3}$	^{113}Tc	1.979×10^{3}	^{104}Y	4.265×10^{3}
^{151}Pm	1.673×10^{4}	^{115}Rh	9.618×10^{4}	^{155}Sm	2.291×10^{5}	^{115}Tc	2.489×10^{1}	^{105}Y	3.770×10^{2}
^{152}Pm	2.232×10^{6}	^{117}Rh	1.015×10^{5}	^{156}Sm	4.894×10^{3}	^{117}Tc	1.936×10^{-1}	^{107}Y	6.257×10^{-1}
^{154}Pm	5.621×10^{5}	^{119}Rh	7.231×10^{2}	^{157}Sm	9.208×10^{4}	^{99}Tc	2.023×10^{-4}	^{90}Y	1.439×10^{2}
^{156}Pm	1.941×10^{5}	^{121}Rh	9.077×10^{0}	^{158}Sm	1.424×10^{4}	^{99m}Tc	3.921×10^{3}	^{90m}Y	1.249×10^{1}
^{157}Pm	6.816×10^{4}	^{123}Rh	8.700×10^{-2}	^{159}Sm	1.735×10^{4}	^{123m}Te	1.660×10^{-7}	^{91}Y	5.852×10^{1}
^{158}Pm	1.855×10^{4}	^{103}Ru	8.895×10^{3}	^{161}Sm	6.947×10^{2}	^{125m}Te	3.351×10^{-4}	^{91m}Y	1.132×10^{6}
^{159}Pm	2.456×10^{3}	^{105}Ru	3.241×10^{5}	^{165}Sm	1.874×10^{2}	^{127}Te	2.995×10^{1}	^{92}Y	1.936×10^{6}
^{161}Pm	1.398×10^{1}	^{106}Ru	1.425×10^{2}	^{117m}Sn	2.942×10^{4}	^{127m}Te	1.166×10^{1}	^{93}Y	1.015×10^{6}
^{142}Pr	6.694×10^{-3}	^{107}Ru	2.883×10^{6}	^{119m}Sn	7.514×10^{-1}	^{129}Te	5.948×10^{4}	^{94}Y	4.245×10^{7}
^{142m}Pr	2.790×10^{-1}	^{108}Ru	7.376×10^{5}	^{121}Sn	2.013×10^{3}	^{129m}Te	5.284×10^{1}	^{95}Y	6.901×10^{7}
^{143}Pr	3.861×10^{1}	^{111}Ru	3.447×10^{5}	^{121m}Sn	5.873×10^{-6}	^{131}Te	4.018×10^{6}	^{97}Y	8.450×10^{7}
^{144}Pr	1.471×10^{3}	^{112}Ru	1.753×10^{5}	^{123}Sn	5.637×10^{0}	^{131m}Te	2.421×10^{4}	^{98}Y	6.053×10^{7}
^{144m}Pr	4.572×10^{2}	^{113}Ru	9.481×10^{4}	^{123m}Sn	7.256×10^{4}	^{132}Te	1.438×10^{5}	^{99}Y	3.370×10^{7}
^{146}Pr	1.483×10^{6}	^{115}Ru	8.187×10^{3}	^{125}Sn	2.155×10^{2}	^{133}Te	3.264×10^{7}	^{72}Zn	4.795×10^{0}
^{147}Pr	1.973×10^{7}	^{117}Ru	8.035×10^{2}	^{125m}Sn	2.817×10^{5}	^{133m}Te	9.196×10^{6}	^{73}Zn	4.048×10^{3}
^{149}Pr	1.776×10^{7}	^{122}Sb	3.917×10^{-3}	^{126}Sn	2.655×10^{-4}	^{134}Te	2.714×10^{7}	^{76}Zn	2.295×10^{4}
^{151}Pr	5.031×10^{6}	^{122m}Sb	7.398×10^{-1}	^{127}Sn	1.490×10^{5}	^{135}Te	5.506×10^{7}	^{77}Zn	6.254×10^{4}
^{153}Pr	5.459×10^{5}	^{124}Sb	2.598×10^{-2}	^{127m}Sn	7.921×10^{5}	^{136}Te	3.145×10^{7}	^{78}Zn	7.186×10^{4}
^{155}Pr	1.154×10^{4}	^{124m}Sb	1.121×10^{2}	^{128}Sn	1.102×10^{6}	^{137}Te	7.064×10^{6}	^{79}Zn	2.772×10^{4}
^{156}Pr	8.618×10^{2}	^{125}Sb	1.355×10^{0}	^{129}Sn	2.947×10^{6}	^{138}Te	1.462×10^{6}	^{80}Zn	1.266×10^{4}
^{157}Pr	5.399×10^{1}	^{126}Sb	1.051×10^{1}	^{129m}Sn	5.808×10^{6}	^{139}Te	2.179×10^{5}	^{81}Zn	2.211×10^{3}
^{158}Pr	2.166×10^{0}	^{126m}Sb	3.827×10^{3}	^{131}Sn	1.642×10^{7}	^{140}Te	2.030×10^{4}	^{82}Zn	1.711×10^{1}
^{159}Pr	3.599×10^{-2}	^{127}Sb	1.586×10^{3}	^{132}Sn	9.916×10^{6}	^{141}Te	7.038×10^{2}	^{101}Zr	5.808×10^{7}
^{239}Pu	5.442×10^{-7}	^{128}Sb	5.662×10^{3}	^{133}Sn	2.835×10^{6}	^{142}Te	1.382×10^{1}	^{102}Zr	8.892×10^{6}
^{240}Pu	1.603×10^{-8}	^{129}Sb	3.655×10^{5}	^{134}Sn	1.996×10^{5}	^{231}Th	4.533×10^{-4}	^{104}Zr	1.346×10^{6}
^{241}Pu	5.396×10^{-9}	^{130}Sb	9.151×10^{5}	^{135}Sn	2.060×10^{4}	^{233}Th	1.560×10^{-9}	^{105}Zr	1.729×10^{5}
^{86}Rb	5.349×10^{-1}	^{131}Sb	1.640×10^{7}	^{136}Sn	9.148×10^{2}	^{234}Th	2.352×10^{-7}	^{106}Zr	4.149×10^{4}
^{86m}Rb	9.233×10^{2}	^{132}Sb	2.697×10^{7}	^{101}Sr	4.960×10^{4}	^{233}U	5.871×10^{-9}	^{107}Zr	1.992×10^{3}
^{87}Rb	1.371×10^{-9}	^{132m}Sb	1.676×10^{7}	^{103}Sr	8.061×10^{1}	^{234}U	8.850×10^{-9}	^{108}Zr	3.026×10^{-1}
^{88}Rb	1.305×10^{6}	^{133}Sb	3.732×10^{7}	^{104}Sr	1.391×10^{0}	^{235}U	6.028×10^{-2}	^{93}Zr	5.534×10^{-4}
^{89}Rb	3.369×10^{7}	^{134}Sb	4.517×10^{6}	^{87m}Sr	1.069×10^{0}	^{236}U	3.521×10^{-4}	^{95}Zr	5.167×10^{3}
^{90}Rb	7.542×10^{7}	^{134m}Sb	4.317×10^{6}	^{89}Sr	2.414×10^{3}	^{237}U	5.026×10^{1}	^{97}Zr	1.110×10^{6}
^{90m}Rb	1.500×10^{7}	^{135}Sb	3.300×10^{6}	^{90}Sr	5.281×10^{1}	^{238}U	7.064×10^{-4}	^{98}Zr	9.664×10^{7}
^{91}Rb	9.404×10^{7}	^{136}Sb	5.015×10^{5}	^{91}Sr	1.792×10^{6}	^{239}U	9.360×10^{5}	^{99}Zr	9.547×10^{7}
^{92}Rb	7.961×10^{7}	^{137}Sb	3.575×10^{4}	^{92}Sr	6.841×10^{6}	^{240}U	9.866×10^{-1}		
^{93}Rb	5.902×10^{7}	^{138}Sb	2.226×10^{3}	^{93}Sr	8.331×10^{7}	^{241}U	7.443×10^{-4}		

Table E-5. Total Fission Product Releases for PIPET and GTA Maximum Operating Scenarios

Isotope	Release (Ci) PIPET	Release (Ci) GTA
Br-88	1.255×10^{-1}	1.736×10^{-1}
Kr-88	8.645×10^{3}	$1.25 \times 10^{+5}$
Rb-88	1.132×10^{3}	$2.844 \times 10^{+4}$
Kr-91	1.927×10^{2}	$1.304 \times 10^{+2}$
Rb-91	8.491×10^{3}	$2.395 \times 10^{+4}$
Sr-91	1.561×10^{4}	$2.544 \times 10^{+5}$
Y-91m	4.455×10^{2}	$1.364 \times 10^{+4}$
Y-91	4.391×10^{-1}	$1.394 \times 10^{+1}$
Sr-92	7.548×10^{4}	$1.019 \times 10^{+6}$
Y-92	9.255×10^{2}	$2.330 \times 10^{+4}$
Sr-95	6.994×10^{4}	$1.412 \times 10^{+5}$
Y-95	1.198×10^{5}	$7.076 \times 10^{+5}$
Zr-95	4.863×10^{0}	$7.456 \times 10^{+1}$
Nb-95m	4.285×10^{-3}	6.234×10^{-2}
Nb-95	3.749×10^{-2}	1.126×10^{-2}
Zr-97	4.354×10^{2}	$6.285 \times 10^{+3}$
Nb-97m	5.155×10^{2}	$6.539 \times 10^{+3}$
Nb-97	8.050×10^{1}	$1.779 \times 10^{+3}$
Mo-105	3.379×10^{1}	$9.375 \times 10^{+1}$
Tc-105	1.556×10^{2}	$1.500 \times 10^{+3}$
Ru-105	1.621×10^{0}	$3.401 \times 10^{+1}$
Rh-105m	3.415×10^{-1}	8.202×10^{0}
Rh-105	1.450×10^{-3}	6.369×10^{-2}
Sn-132	7.370×10^{-2}	1.833×10^{-1}
Sb-132m	1.010×10^{0}	6.499×10^{0}
Sb-132	1.208×10^{0}	7.357×10^{0}
Te-132	3.390×10^{-1}	6.260×10^{0}
I-132	1.145×10^{-2}	2.796×10^{-1}
Sn-133	1.201×10^{-2}	2.790×10^{-2}
Sb-133	1.282×10^{0}	5.765×10^{0}
Te-133m	3.834×10^{1}	$5.448 \times 10^{+2}$
Te-133	7.196×10^{1}	$8.983 \times 10^{+2}$
I-133m	6.523×10^{-2}	4.298×10^{-2}
I-133	2.431×10^{-1}	6.119×10^{0}
Xe-133m	4.531×10^{-1}	6.621×10^{0}
Xe-133	3.846×10^{-1}	7.806×10^{0}
Sb-134	6.145×10^{-2}	5.724×10^{-2}
Te-134	9.332×10^{1}	$1.232 \times 10^{+3}$
I-134m	1.358×10^{0}	7.999×10^{0}
I-134	5.223×10^{0}	$1.230 \times 10^{+2}$
Te-135	5.511×10^{0}	9.016×10^{0}
I-135	1.139×10^{0}	$1.262 \times 10^{+1}$
Xe-135m	4.273×10^{3}	$4.950 \times 10^{+4}$
Xe-135	2.194×10^{2}	$4.014 \times 10^{+3}$
Cs-135m	1.745×10^{2}	$2.274 \times 10^{+3}$
I-138	9.213×10^{-2}	3.134×10^{-2}
Xe-138	2.348×10^{5}	$2.564 \times 10^{+6}$
Cs-138m	2.972×10^{4}	$1.494 \times 10^{+5}$
Cs-138	6.572×10^{4}	$1.319 \times 10^{+6}$
Xe-140	2.080×10^{3}	$2.439 \times 10^{+3}$
Cs-140	3.133×10^{5}	$9.242 \times 10^{+5}$
Ba-140	1.299×10^{2}	$1.151 \times 10^{+3}$
La-140	1.313×10^{-1}	2.561×10^{0}
Ba-142	1.876×10^{2}	$1.904 \times 10^{+3}$
La-142	5.863×10^{0}	$1.195 \times 10^{+2}$

Source: Young, 1992.

Table E-6. Fission Product Release Fractions for Elements

Release Category	Release Basis (diffusion)	Release Average (percent)	Grouped Elements
Nobles[a]	Xe, Kr	3.0	Xe, Kr
Halogens	I	1.0	I, Br
HR[b] non-Volatiles	Cs, Sr	13.0	Cs, Rb, Na, Cu, Sr, Ba, Mg, Be
LR[c] non-Volatiles	Zr, Nb, Mo, Tc, Te, Ba	1.6	Te, Se, Sb, Po, Ru, Rh, Pd, Nb, Mo, Tc, Zr, Ce, Th, Pa, U, Np, Pu, C, La, Al, Y, Ac, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Am, Sn, Ag, In, Ge, Ga, Gd, Zn, As, Si

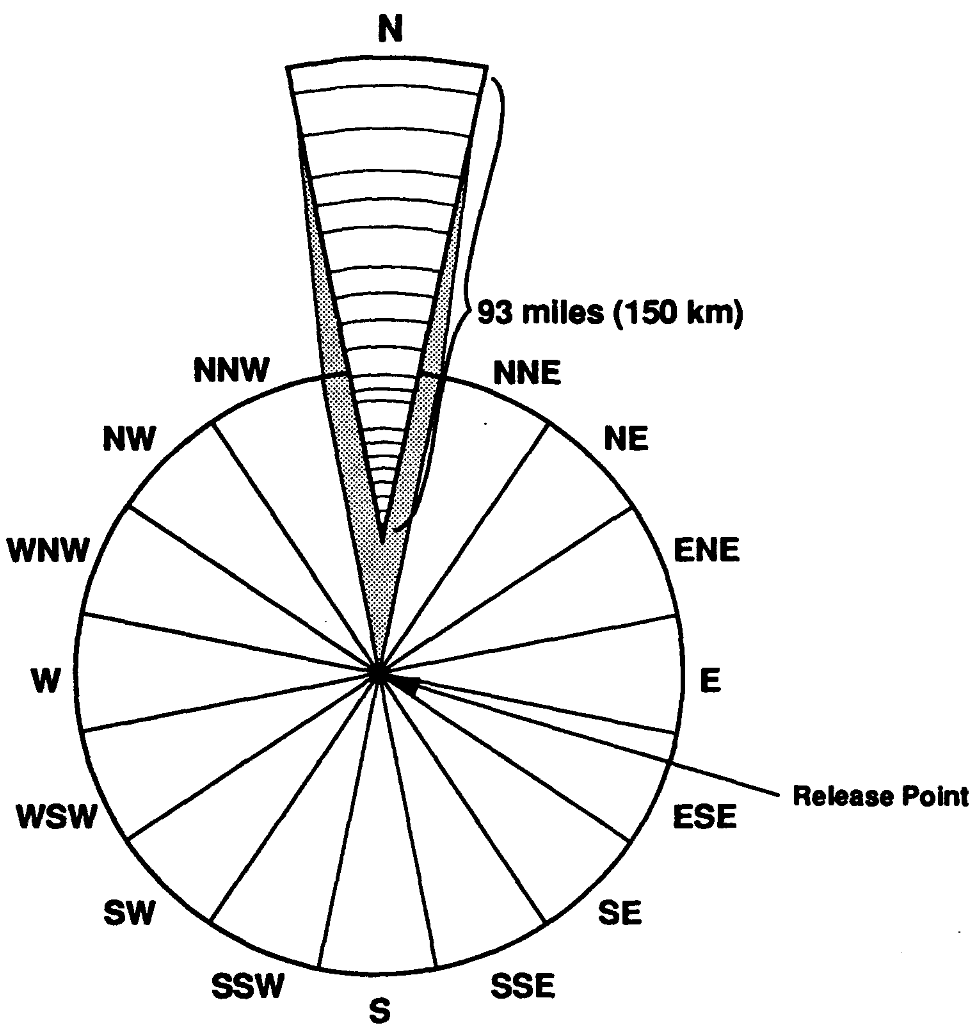
Notes: *(a) 100 percent of the activated hydrogen is assumed to be released.*
(b) High Release.
(c) Low Release.

represent industry acceptable standards and are the baseline efficiencies toward which the current ETS is being designed. The corresponding ETS particulate release fractions used in the analyses below are 0.1 percent particulate releases and 0.5 percent noble, halogen, and volatile, releases.

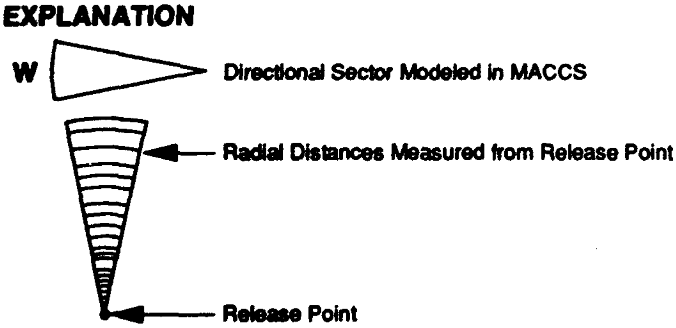
1.4 POPULATION SITE SPECIFIC DATA

Generally, site-specific data are collected within a radius of 80 kilometers downwind from the point of release. This has been standard practice in the past for evaluating radiological estimates for inclusion in impact analyses, and is set forth for evaluation of normal operations in 40 CFR 61, EPA NESHAP Policy. However, it was determined that for PBR propulsion technology evaluation, the distance downwind would be extended to 150 kilometers in order to include major population centers. This can be considered a reasonable and conservative approach where radiation doses may be as high as, or higher than, local background contributions. This is done with the understar ıg that Gaussian plume models such as MACCS are generally regarded as being unreliable for distances much past 100 kilometers. However, the estimates yielded by these codes are considered conservative even to long distances from the release point. The additional exposure to people located beyond 150 kilometers would contribute very little to the total population dose and, therefore, is not considered.

For input into MACCS, population data are arranged onto a circular (polar) grid divided into 16 directional sectors and 26 radial distances measured from the source point to 150 kilometers distant (Figure E-1). Population doses estimated from this data assume that the population in each grid



EXPLANATION



MACCS Polar Grid

Figure E-1

element is distributed evenly over the surface of the element. Populations of major cities surrounding NTS are taken from 1990 census data provided by NTS (Leppert, 1992). Rural populations (including individual ranch sites) are taken from a 1989 U.S. EPA census (Thome, 1991). NTS crop, livestock, and water pathway data were extracted from the site radiological monitoring report (Environmental Protection Agency, 1991) and input directly into the MACCS site file.

INEL population data for major cities and rural populations are taken from 1990 census data. The population data were input into MACCS in the same manner as described for the NTS data. Crop, livestock, and water pathway data for INEL were taken from a socioeconomic database (Hardinger, 1990) produced for the southeastern portion of the state of Idaho.

2.0 IMPACT ANALYSIS

2.1 OPERATIONAL SCENARIOS

Normal I

Normal I experiments include initial startup, zero-power, and low-power physics tests. Testing under these conditions may be performed without coolant flow, and under normal operating conditions (non-accident) would not release radiological materials to the environment since test conditions would be significantly below full-power operation conditions. For this reason, Normal I experiments are not discussed or analyzed further.

Normal II

Normal II experiments are standard tests that would operate within the fuel design envelope, up to the core's rated full power (550 MW for PIPET and 2,000 MW for GTA). These experiments would allow the release of small amounts of the core inventory due to heat-induced release, properties of the fuel particles themselves, and cracking of a small number of fuel particles during each test. The amount of fission products released from the core as a result of a Normal II operation would be as discussed in Section 1.3. PBR propulsion technology Normal II experiments would be performed using both GTA and PIPET cores.

Normal III

Normal III experiments, which would be performed using PIPET cores only, involve operations to determine fuel design margins, with the intent of quantifying actual design limits. These experiments would include over-power, reduced coolant flow, and extended duration testing. These tests may involve full or partial fuel element failure where some fraction of the fuel in one or more fuel elements is released into the ETS. Current

assessments of these experiments envision reduced run times (minimizing the inventory) with only partial failure of some of the fuel elements (minimizing the release). However, for purposes of performing conservative impact analyses, it is assumed that 100 percent of the core fission product inventory is released following a maximum case test. It is important to realize that the intent of these tests is to define the design margin, not to purposely fail the core. In actual testing no fuel element failure or release of significant portions of the core inventory to the ETS may occur.

2.2 IDENTIFICATION OF BOUNDING CASE SCENARIOS

Release Mechanisms

Source terms pertaining to Normal II and III operations are emitted in multiple plume segments. Normal II operations are simulated with two distinct plume segments. The first occurs during the course of a GTA or PIPET operation and consists of nominal diffusion driven and failed fuel fission product release, specified in Tables E-5 and E-6. The second Normal II plume segment releases volatile isotopes trapped by the absorber-beds during operation after they have decayed to safe levels. The time following operation after which the volatiles are released is assumed to be one day.

A third plume segment is used to model PIPET Normal III operations, in addition to the two previously mentioned plumes. This plume segment occurs at the end of the experiment, in which the remaining PIPET core inventory (100 percent) is assumed to enter the ETS over a small time interval of a few seconds and is subsequently released in accordance with ETS retention efficiencies.

Bounding Case Scenarios

A GTA core would undergo no more than 2.0 TJ total usage, which can be represented by a single maximum case test run of 2,000 MW for 1,000 seconds. Such a maximum case test would result in the highest total core inventory, since at the immediate conclusion of such an operation the maximum possible amount of all fission products would be present, with no time for decay of short-lived isotopes. Thus, the inventory present in a GTA core at the conclusion of a maximum case test run would represent the largest fission product inventory for evaluation. This inventory (Table E-4) is used for determination of the source term for the bounding case GTA Normal II operational impact. For isotopes in which specific release fractions have been established, this calculated value will be used (see Table E-5). Released amounts for the remaining inventory are estimated using the criteria established in Table E-6. Since Normal III operations would be conducted for PIPET only, no analysis of this case is performed for GTA.

Each PIPET core can undergo a series of tests, up to the maximum lifetime usage of 1.375 TJ. Each test in this series can be separated by a week or more of post-test decay time before another operation is initiated. With each consecutive operation, the long-lived fission product inventory of the core would increase, since these long-lived isotopes would not decay significantly between test runs, and may in fact increase due to decay of shorter-lived precursor isotopes. For modeling purposes, this is represented by five maximum case test operations (550 MW for 500 seconds). The core inventory resulting from the test series is calculated by allowing 1 week of decay time between test operations (this is quite conservative, since the time between tests is expected to be much longer). The case of the core inventory immediately following the fifth test run would thus represent the maximum for all fission product isotopes, including long-lived species. This core inventory has been selected as the bounding case for the PIPET Normal II and Normal III analyses. As for GTA, Normal II PIPET inventory escaped quantities would be as shown in Table E-5 or calculated using Table E-6 criteria. For PIPET Normal III operations, the entire inventory is assumed to be released into the ETS.

The maximum case yearly operational impact is also assessed. The bounding case for this analysis is found by assuming testing of two PIPET cores, each operating 5 times at 550 MW for 500 seconds, and two GTA cores, each operating once at 2,000 MW for 1,000 seconds (see Section 1.3). In determining the contribution to annual dosage provided by the two PIPET cores, the final test of one of the cores is considered to be a Normal III experiment, the remaining nine tests are considered to be Normal II. The reported dose is the sum of the nine Normal II operations, and the one Normal III operation for two PIPET cores, and two Normal II GTA operations.

Impacts due to the entire PBR propulsion technology development and validation are based upon the cumulative effect of a 10-year test program duration. This would consist of five PIPET and one GTA Normal II operations each year, with a total of four PIPET Normal III operations during the 10-year period replacing four of the PIPET Normal II tests.

2.3 IMPACT ASSESSMENT

Impacts of Normal II and Normal III operations are provided based upon results of analysis for bounding case scenarios using the MACCS computer code. Meteorological conditions are assumed to correspond to the model conditions presented in Table E-1 for both SMTS and CTF, since pre-test forecasting and analysis would preclude conditions which may produce impacts greater than those presented here.

Results are presented for a single test run of each bounding case operational scenario, the maximum yearly impact, and the PBR propulsion technology

assessment lifetime, which is assumed to be 10 years. Impacts are presented at the facility boundary (the nearest NTS/INEL boundary in the selected wind direction), the location of the MEI, and to the total exposed population dosage. The radiological doses presented in these analyses are expressed as the sum of the external doses received from cloudshine and groundshine and the internal doses received from inhalation during plume passage and later resuspension, and ingestion of contaminated food and water, integrated over a 50-year period. Virtually all the committed dose would be received in the first year following the radiological release.

Normal II Impacts

Tables E-7 and E-8 list the dose to the MEI and the population dose, respectively, for both PIPET and GTA Normal II operations. Both site boundary and peak doses are listed for comparison.

PIPET. The dose at the NTS boundary following a single bounding case location of PIPET Normal II operation at the SMTS is approximately 0.00066 mrem. The MEI occurs at approximately 210 kilometers, with a dose received of 0.0046 mrem. The dose at the INEL boundary following a single PIPET Normal II operation at the CTF is approximately 0.00050 mrem. The location of the MEI at INEL occurs at approximately 135 kilometers, with a dose received of 0.01 mrem.

GTA. The dose at the NTS boundary following a single GTA Normal II operation at the SMTS is approximately 0.009 mrem. The location of the MEI occurs at approximately 190 kilometers, with a dose received of 0.011 mrem. The dose at the INEL boundary following a single GTA Normal II operation at the CTF is approximately 0.012 mrem. The location of the MEI at INEL occurs at approximately 18 kilometers, with a dose received of 0.028 mrem.

The major differences between the magnitude of the INEL and NTS doses are caused by the differences in the selected inversion layer height as evaluated at each site (1.5 kilometers at INEL and 2.0 kilometers at NTS). The maximum population dose for a single PIPET Normal II operation (fifth of a series) may result in the projection of up to 0.00022 additional cancer fatalities and 0.000057 additional genetic disorders at NTS; and 0.0011 additional cancer fatalities and 0.00033 additional genetic disorders at INEL. For GTA, the maximum population dose may result in the projection of up to 0.00017 additional cancer fatalities and 0.000045 additional genetic disorders at NTS, and up to 0.0012 additional cancer fatalities and .00033 additional genetic disorders at INEL. These results are in addition to the normally expected occurrences of these effects.

Table E-7. Normal II Operation Plume Center-Line Dose to the MEI

Core (mrem/yr)	Site	Site Boundary Dose (mrem)	Site Boundary Distance (km)	Peak Dose (mrem)	Peak Distance (km)	Annual Natural Radiation Dose (mrem)
PIPET	NTS	0.00066	39	0.0046	210	383
PIPET	INEL	0.00050	15	0.010	135	402
GTA	NTS	0.0090	39	0.011	190	383
GTA	INEL	0.012	15	0.028	18	402

Normal III Impacts

Tables E-9 and E-10 list the dose to the MEI and population doses, respectively, for the PIPET Normal III operation. Both site boundary and peak doses are listed for comparison.

The dose at the NTS boundary following a PIPET Normal III operation at SMTS would be approximately 0.13 mrem. The location of the MEI would occur at approximately 190 kilometers, with a dose received of 0.53 mrem. The dose at the INEL boundary following a PIPET Normal III operation at the CTF is approximately 0.06 mrem. The location of the MEI would occur at approximately 125 kilometers, with a dose received of 1.2 mrem. Many of the differences between INEL and NTS results discussed for Normal II operations also apply for Normal III operations.

Population doses for a PIPET Normal III operation may result in the projection of approximately 0.02 additional cancer fatalities and 0.005 additional genetic disorders at NTS, and approximately 0.09 additional cancer fatalities and 0.03 additional genetic disorders at INEL.

Maximum Annual Operations

Tables E-11 and E-12 list the dose to the MEI and population doses, respectively, for the maximum yearly total release. The dose at the NTS boundary following the maximum yearly release from the SMTS would be approximately 0.16 mrem. The location of the MEI would occur at approximately 195 kilometers with a dose received magnitude of 0.6 mrem. The dose at the INEL boundary following the maximum yearly release at the CTF would be approximately 0.09 mrem. The location of the MEI at INEL

Table E-8. Normal II Operation Population Dose

Core/Site	Maximum Sector	Direct Exposed Population	Direct Pop. Dose (Person-mrem)	Ingestion Exposed Population	Ingestion Pop. Dose (Person-mrem)	Total Pop. Dose (Person-mrem)	Average Individual Dose (mrem)	Latent Cancer Fatalities	Genetic Disorders
PIPET/NTS	NNE	917	2.0	1,072,718	271.0	273.0	2.4×10^{-3}	2.2×10^{-4}	5.7×10^{-5}
PIPET/INEL	N	6,959	13.0	278,635	1,371.0	1,384.0	6.8×10^{-3}	1.1×10^{-3}	2.9×10^{-4}
GTA/NTS	NNE	917	5.1	1,072,718	209.0	214.0	2.0×10^{-4}	1.7×10^{-4}	4.5×10^{-5}
GTA/INEL	N	6,959	36.0	278,635	1,525.0	1,561.0	1.1×10^{-2}	1.2×10^{-3}	3.3×10^{-4}

Table E-9. PIPET Normal III Operation Plume Center-Line Dose to the MEI

Site	Site Boundary Dose (mrem)	Site Boundary Distance (km)	Peak Dose (mrem)	Peak Distance (km)	Annual Natural Radiation Dose (mrem)
NTS	0.13	39	0.53	190	383
INEL	0.06	15	1.2	125	402

would occur at approximately 125 kilometers, with a dose received of 1.35 mrem. These values are well below the NESHAP standard of 10 mrem.

Population doses for the maximum yearly release may result in the projection of approximately 0.02 additional cancer fatalities and 0.006 additional genetic disorders at NTS, and the projection of approximately 0.1 additional cancer fatalities and 0.03 additional genetic disorders at INEL.

PBR Propulsion Technology Development and Validation Impacts

During the 10-year lifetime of the PBR propulsion technology development and validation, impacts from each year would accumulate and collectively produce the total program-related dose. An average year is considered to consist of five PIPET Normal II Operations, and one GTA Normal II operation. During the 10-year test period, a total of four PIPET Normal III operations will occur which will replace four of the PIPET Normal II tests.

Tables E-13 and E-14 present the cumulative lifetime impacts from the proposed PBR propulsion technology development program. Both dose to the MEI and population doses are listed for comparison.

The dose at the NTS boundary for PBR propulsion technology assessment releases from the SMTS would be approximately 0.64 mrem. The location of the MEI would occur at approximately 190 kilometers with a dose received of 2.5 mrem. The dose at the INEL boundary for PBR propulsion technology assessment releases at the CTF would be approximately 0.50 mrem. The location of the MEI at INEL would occur at approximately 125 kilometers, with a dose received of 5.6 mrem.

Population doses for the lifetime of PBR propulsion technology assessment releases may result in the projection of approximately 0.09 additional cancer fatalities and 0.02 additional genetic disorders at NTS, and the projection of approximately 0.44 additional cancer fatalities and 0.12 additional genetic disorders at INEL.

Table E-10. PIPET Normal III Operation Population Dose

Core/Site	Maximum Sector	Direct Exposed Population	Direct Pop. Dose (Person-mrem)	Ingestion Exposed Population	Ingestion Pop. Dose (Person-mrem)	Total Pop. Dose (Person-mrem)	Average Individual Dose (mrem)	Latent Cancer Fatalities	Genetic Disorders
NTS	NNE	917	86.0	1,072,718	24,600.0	24,686.0	1.2×10^{-1}	2.0×10^{-2}	5.2×10^{-3}
INEL	N	6,959	2,170.0	278,635	116,230.0	118,400.0	7.3×10^{-1}	9.4×10^{-2}	2.5×10^{-2}

Table E-11. Maximum Yearly Release Plume Center-Line Dose to the MEI

	Site Boundary		Peak		Annual Natural Radiation
Site	Dose (mrem)	Distance (km)	Dose (mrem)	Distance (km)	Dose (mrem)
NTS	0.16	39	0.60	195	383
INEL	0.09	15	1.35	125	402

2.4 ACCIDENT SCENARIOS

2.4.1 Severe Accident Hazards Analysis

2.4.1.1 Summary. As part of the preparation of this analysis, the project team reviewed the entire evolution of the project to estimate the maximum possible consequences resulting from hypothetical severe accidents, regardless of their probability. In most cases, a scenario which would produce a particular source term that could impact the environment or the health and safety of workers and the public was presupposed. In one case, the source term was taken as the maximum theoretically possible, i.e., complete vaporization of a core containing the maximum possible fission-product inventory, and its release directly into the atmosphere. Current calculations indicate that no mechanism exists that could rupture both the primary and secondary confinement boundaries to allow such a direct unmitigated release, except through deliberate malevolent actions. Nevertheless, this Level 1 Source Term provides an upper bound on safety impacts. The value of such an unlikely assumption is that it ensures that all credible accidents will have consequences that are much less severe.

The population and regions at risk during severe accidents were divided into three separate groups by location: OSN - on-station personnel (within the facility perimeter fence); OST - on-site (e.g., NTS, INEL) but outside the facility fence; and P - members of the public situated off site. Five levels of source term severity were distinguished, depending on where and when the accident occurred during the facility life-cycle. These source terms then provided the input to the accident consequences calculations of radiation doses and health effects.

2.4.1.2 Introduction. In the preparation of this analysis, the project team systematically reviewed all aspects of the project life cycle in an attempt to ensure that no potential hazards had been overlooked. Although this review resulted in both qualitative and quantitative estimates, it did not perform detailed analyses of all situations. More specific and thorough investigations will be performed for the Safety Analysis Reports required before construction or operations can be approved by the appropriate regulatory

Table E-12. Maximum Yearly Release 50-Year Population Dose

Core/Site	Maximum Sector	Direct Exposed Population	Direct Pop. Dose (Person-mrem)	Ingestion Exposed Population	Ingestion Pop. Dose (Person-mrem)	Total Pop. Dose (Person-mrem)	Average Individual Dose (mrem)	Latent Cancer Fatalities	Genetic Disorders
NTS	NNE	917	114	1,072,718	27,457	27,571	0.15	0.022	0.006
INEL	N	6,959	2,359	278,635	131,547	133,906	0.81	0.106	0.035

Table E-13. Total SNTP Test Program Cumulative Center-Line Dose to the MEI

	Site Boundary		Peak		10-Year Natural Radiation
Site	Dose (mrem)	Distance (km)	Dose (mrem)	Distance (km)	Dose (mrem)
NTS	0.64	39	2.5	190	3830
INEL	0.50	15	5.6	125	4020

agencies. This hazards "walk-through" presents conservative bounding results that can be used to compare the risks of the proposed project to other risks that the public normally accepts in the conduct of its economic, social, and political affairs.

All types of hazards were considered including toxic emissions, fires and explosions, and releases of radioactivity. For this facility, radiological hazards generally dominate the potential impact of the project during both normal operations and potential accidents.

The process of analyzing the potential radiological consequences of a severe accident begins with the definition of a "source term". The particular nuclides (e.g., Xe-133), amounts (in curies), chemistry and morphology (solid, respirable particulate, gas, etc.), half-life, and biological toxicity of the material released to the environment defines the radiological source term. Calculated core inventories for PIPET and GTA cores are shown in Tables E-3 and E-4. These inventories were calculated using ORIGEN2 in accordance with the parameters detailed in Section 1.3. Analysis of these cores led to the description of five distinct source terms that might occur in particular accidents. These source terms are defined in Table E-15.

All of the potential accident scenarios are bounded or encompassed by these five sources. These source terms are then further analyzed by calculating their release to the environment, their transport based on release characteristics (velocity, temperature, composition) and meteorological conditions (wind speed and direction, inversion layer presence and altitude, etc.), and the resulting biological doses based on deposition calculations, hypothetical location of the maximally exposed individual, and population location and density. The integration of the source term with the conditions prevailing at the time of the accident and the transport, dispersal and deposition of the radionuclides determines the level of severity of the accident. Table E-5 presents specific core release quantities for select radionuclides, which together account for approximately 75 percent of the total release. Calculation of releases for the balance of the core inventories are calculated using the core release fraction information found in Table E-6 and the core inventories found in Tables E-3 and E-4.

Table E-14. Total SNTP Test Program Release 50-Year Population Dose

Core/Site	Maximum Sector	Direct Exposed Population	Direct Pop. Dose (Person-mrem)	Ingestion Exposed Population	Ingestion Pop. Dose (Person-mrem)	Total Pop. Dose (Person-mrem)	Average Individual Dose (mrem)	Latent Cancer Fatalities	Genetic Disorders
NTS	NNE	917	487	1,072,718	112,956	113,443	0.64	0.09	0.024
INEL	N	6,959	9,638	278,635	542,876	552,514	3.35	0.44	0.12

Table E-15. EIS Source Term Levels

Level 1 Source Term: all core vaporized coincident with the highest fission-product inventory; direct release to atmosphere without any mitigation.

Level 2 Source Term: all core aerosolized coincident with the highest fission-product inventory; release through ETS with failure of single most critical component and failure of confinement system.

Level 3 Source Term: all core melts; source term from volatiles only (iodine, cesium, noble gases, etc.); release through ETS with failure of single most critical component and failure of the confinement system.

Level 4 Source Term: accidental criticality leading to vaporization of core with no prior fission product inventory; release directly into atmosphere.

Level 5 Source Term: cold core (i.e., no melting or vaporization) fragmented and dispersed by means of an external event (e.g., a hydrogen detonation); release directly into atmosphere.

Three accident consequence levels were chosen for analysis, since they encompass the most severe hypothetical accidents. A detailed discussion of the consequences are summarized in Table E-16 and the following discussion.

Table E-16. Accident Consequence Levels

Consequence Level I: The worst-case hypothetical accident in which the Level 1 Source Term is released to the atmosphere without mitigation.

Consequence Level II: The worst-case hypothetical accident considered to be credible without requiring extremely improbable external events or deliberate malevolent actions. The system is assumed vulnerable to the failure of the single most critical safety component. Source Term Level 2 is employed. Two Consequence II cases are distinguished, depending on whether the release occurs early or late in the accident.

Consequence Level III: This accident involves the complete vaporization of the core with little or no inventory of fission products at the time of the accident. This can occur early in the facility life cycle (during zero- or low-power testing), or late after the fission products have substantially decayed. A Level 4 Source Term applies.

A Consequence I accident assumes Source Term Level 1 under worst-case assumptions for all other initial and boundary conditions (e.g., no credit

taken for agglomeration, condensation or scavenging processes, maximum possible fission product inventory, GTA facility, etc.).

There are two Consequence II accidents, both of which employ Source Term Level 2. The accidents are assumed to occur following the maximum GTA operational cycle. The ETS is intact except for the assumed failure of the eight absorber bed stages. Two different failure times are considered: early, in which the prevailing weather conditions satisfy the normal operating safety constraints; and late, 10 hours after the run when the weather can no longer be presumed to be favorable. In the latter case, the worst-case weather is assumed to prevail: 300 meter inversion layer base, 1.0 meter per second wind blowing directly toward the nearest maximum population center (Las Vegas at NTS and Idaho Falls at INEL). The Level 3 Source Term is not calculated separately, since its consequences are less than those produced by Level 2 for these accident scenarios.

A Consequence III accident is assumed to occur during low-power testing if an inadvertent criticality occurs before the confinement system is in place. Although highly unlikely, some of the core could be vaporized and be released directly into the atmosphere. The same consequences can be considered to be bounding for any accidental criticality that occurs outside the confinement (e.g., during handling or storage) when the fission product inventory is very low. This accident would involve a Level 4 Source Term. The Level 5 Source Term is considered to lead to much more benign consequences than the previous accidents; therefore, it was not analyzed separately.

Following is a brief overview of the hazards "walk-through" for various stages of project development and facility operations.

On-Station Handling and Storage Prior to Testing

A key concern in handling and storing test articles prior to testing is the possibility of accidental criticality. With proper design and engineering, the potential for accidental criticality can be discounted, thereby limiting the source term to Level 5. However, even if such an event were to occur, the source term would be less than Level 4, resulting in an accident of severity less than Consequence III.

In the absence of inadvertent criticality, a potential hazard arises from the energetic dispersal of uranium and/or beryllium due to a hydrogen detonation. However, the beryllium would not be hazardous unless burned or aerosolized; the heat flux from a hydrogen deflagration or detonation is insufficient to ignite or aerosolize the beryllium even if it were directly exposed to the flame. Inside the reactor vessel, there is no explosion hazard capable of releasing the beryllium. Fragmentation due to detonation-

produced loads would limit the contamination and biological hazards to a very localized region around the facility.

Very unlikely external events can be postulated as accident initiators. These include airplane crashes into the facility, strong earthquakes, lightning strikes, terrorist attacks, or hydrogen detonations. In order to present an off-site threat to the public or the environment, radionuclides would have to be lofted into the air and subsequently fall out in populated areas.

In all cases, the consequences of non-deliberate events would involve source terms no worse than Level 5. Only in the case of deliberate sabotage could the source approach Level 4. The consequences of all such accidents are bounded by the Consequence III accident described in Section 2.4.2.

Low Inventory Testing

Low-inventory testing would not be initiated until the full Coolant Supply System (CSS) and Effluent Treatment System (ETS) were in place and operational. Although the fission product inventory could exceed the Level 4 Source Term, it would be less than Level 2. The Late-Time Accident Consequence II "Late" calculation (Section 2.4.3) would be bounding in the unlikely event of a severe accident, since no controls on the prevailing weather would apply, nor would sheltering or evacuation requirements be in place.

Power Testing

Credible reactor accident scenarios include (1) loss of flow while at high power; (2) reactivity addition accidents such as cold hydrogen flood while critical, or inadvertent control rod or safety rod movement; and (3) loss of cooling during post-operation cooldown (i.e., decay heat removal). The first two scenarios are calculated to lead to immediate ejection of the fuel as an aerosol terminating the power excursion with less than 100 MJ or 300 MJ respectively of additional fission yield produced in the excursion. The excursion yield is thus 0.0036 percent of the maximum inventory following a normal series of operations.

Normal safety precautions would apply during all power testing, including protection of on-station workers, and operations constrained to coincide with favorable weather patterns, i.e., when wind direction and inversion layers are such that the dispersal of fission products is towards the least populated areas.

For potential consequences to on-site (OST) and off-site (P) personnel, source term Levels 1, 2 or 3 would be bounding for design basis accidents (DBAs) or severe accidents (beyond DBA). The chosen approach assumes

that the DBA is a continuous rod withdrawal accident from low power. This can only occur during testing, when favorable weather conditions prevail. Hence, the early Consequence II accident would be bounding.

The third accident scenario to be considered is a postulated loss-of-coolant-accident (LOCA) during post-operation cooldown. (A LOCA during operation is considered above.) Since the ETS is to be designed to absorb the effects of a core vaporization, the LOCA would result in a release to the atmosphere only if there were a concurrent failure of the ETS. Although such a concurrent failure is an improbable event, the following discussion is included to demonstrate that the potential releases are less than those already described as Consequence II accidents.

Calculations have indicated that, if the LOCA occurs more than three hours after the test is terminated, the conduction of the decay heat from the fuel will be sufficient to prevent any significant melting. Should the LOCA occur during the three hours immediately following a test operation, the decay heat may produce core melting but is not sufficient for vaporization. Therefore, any release would be less than that already considered as Source Term Level 3. Furthermore, the releases, should they occur, would happen within the weather predictability window (expected to be about 10 hours). Thus, the consequences of postulated LOCAs during the post-operation cooldown period are bounded by the Consequence II "Early" accident described in some detail in Section 2.4.2.

Long-Term Post Test Cooling

The test articles will remain within the test cell for an extended cooling period and to allow substantial decay of the radionuclides. Within this configuration, the source term would probably be substantially less than Level 4, since the moderate fission product inventory would be significantly mitigated by the presence of the ETS. Even in the extremely unlikely event of an inadvertent criticality with some inventory, the source term would be less than Level 2.

Maintenance and Inter-Test Period

As long as the test article remains within the confinement, source terms would be less than Level 2 credible mechanistic accident scenarios. The bounding accident would be represented by Consequence II "Late." However, the probability of such a consequence is extremely unlikely. In the analysis, no credible accident involving hydrogen detonations was capable of failing the reactor vessel (primary confinement) or any major component of the ETS. This was true either as a result of the structural strength of the component, or the impossibility of introducing oxygen into a hydrogen-pressurized system. Similarly, no mechanism was uncovered that would lead to recriticality as a result of a nearby hydrogen detonation.

Deinstallation, Storage, and Transportation

Since the radioactivity of the test article has substantially decayed, source terms should not exceed Level 4. Similarly, no physical mechanism was identified by which criticality could occur as a result of an external explosion. The most serious event would involve fragmentation and local dispersion of large core fragments; hence, the Source Term would not exceed Level 5. Transportation of radioactive material off site might involve accidents leading to dispersal of the material. However, these transportation accidents are separately considered.

Decommissioning

A detailed investigation of decontamination and decommissioning of the facility at the end of its useful life will be performed as part of the SAR process in the program. No environmental or safety impact is expected in this process that would exceed the accident consequences already examined in the earlier phases of the project.

2.4.2 Evaluation of Potential Accident Scenarios

Consequence I

A Consequence I accident is considered the maximum possible hypothetical accident. The accident assumes the total release of all radioactive material of a maximum inventory GTA core immediately following operation. The inventory is assumed to be released from the core in a completely aerosolized fashion to maximize the radiological consequence. The released material is assumed to bypass completely the ETS and any secondary confinement. No account for agglomeration, condensation, or scavenging processes is taken, which ensures that the maximum inventory is dispersed outside of the test site boundary. Each of these assumptions represents an overly conservative bound which cannot be realized physically.

Consequence II

A Consequence II accident is considered the maximum credible postulated accident scenario. A Consequence II accident can result if a critical ETS component fails following the end of a maximum operational cycle, placing the maximum inventory into that component. The critical component is assumed to be the cryogenic adsorber beds (a series of multiple parallel stages) which are assumed to have the potential to fail any time during or following an operation. For conservatism, 100 percent of the core is assumed to be released into the ETS. For this case all of the noble gas inventory is released into the atmosphere, while particulates and other non-gaseous materials are mainly trapped in the ETS particulate and charcoal filters, and thus not released. This accident is considered for PIPET only. It

would require the simultaneous failure of three independent systems for a GTA reactor to experience this scenario (reactor core integrity, ETS adsorber beds, and the ETS confinement system), which is considered incredible.

Two different failure times are considered. The first occurs immediately following the end of a PIPET Normal III operation. Model weather conditions are assumed, since this release would occur within the 10-hour forecast window. This accident is termed the Consequence II "Early" scenario.

The second time at which an adsorber bed can be assumed to have failed occurs after the 10-hour forecast window. For this reason nominal weather conditions can no longer be assumed. Instead, credible weather conditions which produce the maximal impact are assumed to prevail (F stability, 1.0 m/s wind speed, and a 300 m inversion layer base). Additionally, the wind is assumed to be blowing directly toward the nearest maximum population center (Las Vegas at NTS and Idaho Falls at INEL). This accident is termed the Consequence II "Late" scenario in the remainder of this section.

Consequence III

During initial installation of a GTA or PIPET core, some zero or low-power testing (Normal I operations) would be conducted. Although highly unlikely, an accidental reactor control rod withdrawal could occur before the reactor containment and confinement system are in place. In this event, the reactor would experience a brief, but intense, power excursion that could result in fuel vaporization and subsequent release directly into the atmosphere. The resulting inventory would contain fission products from approximately 10^{18} fission events (equivalent to 110 MW for 0.5 seconds of GTA operation) (Sherman, 1991), and would be released at ground level. Although the intent would be to perform the zero-power testing in at least model weather conditions, weather conditions producing the maximal impact are assumed for conservatism (F stability, 1.0 m/s wind speed, and a 300 meter inversion height). Additionally, the wind is assumed to be blowing directly toward the nearest maximum population center (Las Vegas at NTS and Idaho Falls at INEL).

Preliminary analysis performed using these accident scenarios has shown the Consequence II "Late" accident with a PIPET core to be the conservative bounding case scenario. Although greater impacts are calculated using a Consequence I accident, no credible design-based situation is conceivable which could result in its occurrence, thus it will not be considered in this analysis. The potential for occurrence of even a Consequence II type accident is remote, since it would depend upon the simultaneous failure of two independent reactor systems; failure of the complete ETS cryogenic adsorber system, and failure of the confinement or isolation system which would otherwise prevent uncontrolled release of radioactive material during an accident. The probability of such an occurrence, termed a "two-point"

failure, is remote; while the failure of either system is low, the simultaneous failure of both is almost inconceivable.

2.4.3 Bounding Case Accident Impacts

Tables E-17 and E-18 list the dose to the MEI and population dose, respectively, for the Consequence II "Late" accident. The site boundaries for this accident are reported closer to the release point (23 kilometers at NTS, and 10 kilometers at INEL) than was used in the Normal-case operations analyses as a result of the wind direction changes.

Table E-17. PIPET, Consequence II "Late" Accident Plume Center-Line Dose to the MEI

	Site Boundary		Peak		Annual Natural Radiation
Site	Dose (mrem)	Distance (km)	Dose (mrem)	Distance (km)	Dose (mrem)
NTS	23.5	23	23.5	23	383
INEL	24.0	3	30.0	10	402

The dose at the NTS boundary for this accident occurring at SMTS is approximately 23.5 mrem. The dose at the INEL site boundary for this accident occurring at CTF is approximately 24.0 mrem. The MEI doses are 23.5 mrem at NTS and 30.0 mrem at INEL. Although these values do not take into account the effects of evacuation they are well below the ANSI/ANS Report 15.7 guideline of 500 mrem (0.5 rem).

Population doses as a result of a Consequence II "Late" accident are evaluated in the southeast (SE) wind sector for NTS (i.e., Las Vegas), and the SE sector at the CTF (i.e., Idaho Falls). The projected latent effects which may be caused by the Consequence II "Late" accident may be approximately 0.37 additional cancer fatalities and 0.10 additional genetic disorders at NTS, and approximately 1.4 additional cancer fatalities and 0.36 additional genetic disorders at INEL. These values represent the maximum accident-case impact for PBR propulsion technology assessments.

An initial analysis of a Consequence I accident, using a GTA core to yield the source term and occurring under model weather conditions, was undertaken. Impacts produced (see discussion of consequences in Section 2.4.2), by such an accident, while recognized as not physically possible to produce, serve as a baseline against which the bounding case can be compared. At NTS, a GTA Consequence I accident could result in an MEI dose received of 221 mrem at a distance of 180 kilometers, while at INEL

Table E-18. PIPET, Consequence II "Late" Accident 50-Year Population Dose

Site	Maximum Sector	Direct Exposed Population	Direct Pop. Dose (Person-mrem)	Ingestion Exposed Population	Ingestion Pop. Dose	Total Pop. Dose (Person-mrem)	Average Individual Dose (mrem)	Latent Cancer Fatalities	Genetic Disorders
NTS	SE	974,109	401,000	1,072,718	64,000	465,000	4.7×10^{-1}	3.7×10^{-1}	9.8×10^{-2}
INEL	SE	66,441	360,000	278,635	1,361,000	1,721,000	1.0×10^{1}	1.4×10^{0}	3.6×10^{-1}

such an accident would produce an MEI dose received of 560 mrem at a distance of 120 kilometers.

Likewise at NTS, a GTA Consequence I accident at NTS could produce as many as 0.17 additional cancer fatalities and 0.045 additional genetic disorders in the exposed population, and at INEL an additional 7.6 additional cancer fatalities and 2.0 additional genetic disorders.

3.0 RADIOLOGICAL IMPACTS OF TRANSPORTATION

The impacts of transporting feed, fresh product, irradiated product and low-level waste (LLW) for the program were analyzed using the RADTRAN computer code developed by Sandia National Laboratories (SNL). This section describes this computational method and the analysis performed.

The purpose of this analysis is to provide a technical assessment of radiological and nonradiological risk associated with transportation of radioactive materials used for system development work at ground test facilities. This analysis does not assess "social amplification of risk," which may be affected by public perceptions (Kasperson et al., 1988). No generally accepted method has yet been developed for the formal analysis of these factors. However, awareness of these concerns is responsible, at least in part, for the recognition of "secondary factors" in the U.S. Department of Transportation (DOT) routing guidelines and for the strong tendency toward conservatism (i.e., toward overestimation of risk) in the risk analysis.

3.1 RADTRAN MODEL

The RADTRAN 4 risk analysis model was developed by SNL to calculate radiological risks associated with the transport of radioactive materials by a variety of modes, including truck, rail, air, ship, and barge (Neuhauser and Kanipe, 1991). The RADTRAN 4 computer code consists of two major modules for each transport mode: the incident-free transport module, in which doses resulting from normal transport are modeled; and the accident module, in which consequences and probabilities of accidents are evaluated and used to generate a risk estimate. RADTRAN 4 is the central code of the set of codes and databases developed by SNL to support transportation risk analysis. With these codes and databases, radiological and nonradiological transport risks can be estimated, and they are well suited to complex problems involving multiple package types, transport mode options, and potential destinations. RADTRAN 4 permits the user to describe route segments in detail. This capability is used in the present analysis to generate shipment-level risk values (Neuhauser and Kanipe, 1991).

The single greatest "limitation" facing users of RADTRAN or any code of this type is a scarcity of statistical data for certain input parameters. This

difficulty often can be overcome by using conservative estimates of these parameters (i.e., values that tend to maximize the risk). The resulting risks tend to be overestimates (Neuhauser and Reardon, 1986), but are appropriate for use as bounding estimates in the evaluation of environmental consequences. In this context, use of confidence limits as a measure of uncertainty would be inappropriate.

An extensive analysis of the sensitivity of RADTRAN risk calculations to variations in parameters was performed by Neuhauser and Reardon (1986) for a sample truck transport case. The parameters that had the greatest effect on the incident-free risk calculation for truck transport were found to be, in decreasing order of importance: exposure distance while stopped; package dose rate; packages per shipment; shipments per year; K_0 (a factor that accounts for the shape of the package); distance traveled; stop time; number of persons exposed while stopped; shipments per year; distance from source to crew; and number of crew members. All of these are either deterministic (i.e., have known, fixed values for the problem being analyzed) or can be appropriately bounded by a conservative assumption. The accident risk calculation was sensitive to values for release fraction and for probability of occurrence of accident-severity categories; it was relatively insensitive to changes in accident rate or fractions of travel in urban, suburban and rural population-density zones. Consequently, where data are not available, conservative assumptions regarding package release fractions and accident-severity-category probabilities are used.

3.1.1 Incident-Free Radiological Risk

Included in the incident-free module for highway and rail transport are models describing:

- Dose to persons within 800 meters (2,600 feet) of the transport link
- Dose to persons sharing the transport link
- Dose to persons at stops (e.g., refueling stops, rail classification yards).

The magnitude of this risk depends mainly on the package or shipment dose rate and the surrounding population densities. The package dose rate is defined as the dose rate in millirem per hour at 1 meter (3 feet) from the package surface. The shipment dose rate is defined as the corresponding dose rate at 1 meter from the conveyance. The latter is often used to model multiple-package shipments. Three population density zones (rural, suburban, and urban) are used for interstate highway routes. These correspond to mean population densities at 6,719 and 3,861 persons per square kilometer (250 acres), respectively.

Radiological Accident Risk

Accident risk may be generically defined as the consequences of an accident multiplied by the probability of that accident. In practice, any number of different accident sequences exist, each of which has an associated probability. These various types of accident sequences may be grouped according to their severities; in RADTRAN, each of these groupings is considered an Accident Severity Category. Severity is a function of the magnitudes of the impact, puncture, and thermal forces to which a package may be subjected during an accident. Because all accidents may be described in terms of these basic physical forces, severity is scenario-independent. That is, any sequence of events that results in an accident in which a package is subjected to forces within a certain range is assigned to the Accident Severity Category associated with that range of values. Each value in the severity category matrix represents a conditional probability. This is, each value is the probability, given that an accident occurs, that the accident will be of that particular severity. To determine the expected frequency of each severity category, each value must be multiplied by the baseline accident rate for the mode and population zone. Each population density zone has a distinct baseline accident rate and distribution of accident severities because of differences in average velocity, traffic density, and other factors in rural, suburban, and urban areas.

Radiological consequences were calculated by assigning release fractions to each category for each chemically and physically distinct type of radioisotope. The release fraction is defined as that fraction of the radioisotope group in the package that could be released in a given severity of accident. Release fractions vary by package type. Most solid materials are relatively nondispersible and would be difficult to release in particulate form. Therefore, RADTRAN allows the user to assign values for aerosolized and respirable aerosol fractions of the released radioactive material for each Accident Severity Category. Distinct aerosol and respirable aerosol fractions are assigned by material dispersibility category; these categories describe the physical form of the material (e.g., gas, liquid, solid in powder form, monolithic or nondispersible solid).

RADTRAN contains a meteorological model that allows the user to define the behavior of a plume of particulates, if one is produced by the type of accident considered. Material released in aerosol form is assumed to travel away from the immediate vicinity of an accident in a particulate plume.

To calculate health effects, five exposure pathways are considered:

- Inhalation of respirable aerosols in the passing plume
- Cloudshine, defined as exposure to penetrating radiation (e.g., gamma radiation) from the passing plume

- Groundshine, defined as exposure to penetrating radiation from radioactive material that is deposited on the ground from the plume

- Resuspension, defined as inhalation dose from respirable aerosols that are deposited on the ground by the passing plume and subsequently resuspended

- Ingestion, defined as exposure from ingestion of agriculture products from areas contaminated by particulates from the plume (rural zones only).

Cloudshine and inhalation of respirable aerosols occur only while persons are exposed to the plume. Since persons outdoors would be most directly affected, RADTRAN allows the user to account for pedestrian densities in urban areas. Groundshine, resuspension, and ingestion doses would be incurred at later times, and their magnitudes would depend in part on how rapidly a contaminated area is evacuated and whether the area is cleaned up or restricted from use. RADTRAN allows the user to estimate evacuation times, and it includes contamination thresholds for determining whether interdiction or cleanup will occur. The cleanup level is in accordance with proposed U.S. Environmental Protection Agency (EPA) guidelines.

3.1.2 Total Radiological Risk of Transport

A unit-shipment approach was used to calculate transportation risk. The risk per shipment is calculated and multiplied by the number of shipments of each material type. These products may then be summed to give total risk values.

3.1.3 Nonradiological Risk of Transport

The RADTRAN postprocessor performs calculations for nonradiological unit-risk factors (e.g., risk of fatality from mechanical injury) to determine total nonradiological risks. Note that for these risks the two-way travel distance is used because, while radiological risks may be incurred only for a shipment containing radioactive material, nonradiological risks are equally likely when the transport vehicle is traveling empty.

3.1.4 Representative Routes

To estimate the fraction of truck transport travel in each population density zone, representative interstate highway routes are generated for each origin-destination combination, and population densities along these routes are determined from 1980 census data. These data and one-way mileage estimates are generated by a highway routing code.

3.2 ANALYSIS

3.2.1 Input Data and Modeling of Packages/Shipments

RADTRAN requires substantial amounts of input data to adequately model the packaging, the packaging contents, the vehicle and transport link, and potential radiological consequences. In addition, a conditional probability must be assigned to each Accident Severity Category for each population-density zone, and accident rates for each vehicle type and transport mode must be determined. Many of these values do not change for a specific application. For example, interstate highway lane dimensions do not change regardless of what vehicle type or payload is being analyzed. Since predetermined default values are used for these parameters, the user needs to consider only the values of those parameters that may change as a result of program-specific conditions. In this section, program-specific conditions and related input values are discussed and documented.

Shipments of high-enriched uranium feed material would be received from Oak Ridge, Tennessee. All uranium feed material shipments, for analysis purposes, were considered to be in oxide form. The uranium feed material would be converted to "fresh product" at Lynchburg, Virginia. From Lynchburg, the fresh product would be transported to Albuquerque, New Mexico, and then transported to one of the potential sites of the new PBR validation test facility. At the PBR validation test facility location, the fresh product material would be irradiated in a reactor environment for cumulative time periods ranging from one second to a few thousand seconds. To provide a complete analytical evaluation, it was assumed that the irradiated product material could be subject to one of the following options:

Option 1: Shipment to an off-site hot cell facility for further examination.

Option 2: Treatment as waste for either on-site or off-site disposal depending on the given site's waste acceptance criteria.

In actuality, the irradiated product has negligible economic value considering the cost of recovery and would be disposed at either the installation hosting test activities or the facility accomplishing post irradiation examinations.

LLW would be generated during testing operations. These LLW forms could include filter media, particulates, activated hardware, and contaminated structural materials. The LLW would be disposed of on site. Waste meeting the TRU waste acceptance criteria could not be demonstrated to be produced during the proposed action; however, for both analytical completeness and conservation, SNTP program activities were modeled as generating sufficient TRU waste to account for a single shipment to the Waste Isolation Pilot Plant (WIPP).

A set of conservative baseline conditions was defined for analysis to provide a point of comparison for relative risk assessments. Briefly, each material would be shipped by truck; shipments of feed, fresh product, and irradiated product materials going for further examination would be carried in safe secure transports (SSTs) or by appropriately safeguarded commercial truck. All of the fresh and irradiated product was assumed to be shipped by commercial truck for this analysis. The TRU waste would be grouted and shipped off site by commercial carriers in Type A packages (55-gallon drums) in TRUPACT-II Type B overpacks; the LLW would be packaged according to all applicable regulations and hauled to an on-site LLW disposal facility. The structural materials that might be classified as LLW were all modeled as being broken down into units small enough to fit into 55-gallon drums, with a 50-percent void volume factor accounted for. In actuality, it is probable that at least some of these structural materials would be shipped as low-specific-activity material in bulk form, which would greatly reduce the number of such shipments. Therefore, the risk values given for LLW transportation in this analysis are conservative. A summary of the packaging assumptions used in the analysis is given in Table E-19.

In prior analyses of similar materials (DOE/EIS-0136), two shipment sizes (full and half-full loads) were analyzed, because it was possible that a reduced payload might decrease the consequences of a severe accident and thus reduce the overall risk. The results of this earlier analysis indicate that although there was some reduction in high-severity accident consequences, this was more than offset by the increase in risk because twice as many shipments must be made to transport the same amount of material. Therefore, only full loads are considered in this analysis.

All LLW generated during operations of the proposed new test facility is modeled as being disposed of on site. This waste would consist primarily of fission-product-contaminated material and activated structural materials. The former was modeled as containing the maximum amount of the given material that can be carried in a Type A package. For all materials modeled (filter media, etc.) this amount still contains less than 100 nanocuries per gram of alpha-contaminated material, which is the maximum concentration of alpha-emitting isotopes permitted in LLW; thus the analysis is conservative.

The total output of LLW from operations is expected to be about 1.7×10^6 metric tons with a volume of 46,000 cubic meters (1.6 million cubic feet) (includes 50 percent packing volume allowance), which is equivalent to about 219,250 55-gallon drums. The radionuclide inventory of a package varies from 2 to almost 40 curies; the latter applies only to special form material. Although the transport distance could vary at the two alternative sites for the new test facility, a maximum distance of 50 kilometers (approximately 30 miles) was used for both sites. The average velocity on site was assumed to be 50 kilometers per hour (about 30 miles per hour).

Table E-19. Packaging Assumptions Used in Analyses

Material	Package Type	Estimated Percent of Material	Radioactive Material Form and Content	Radiation Dose Transport Index (TI) per Package	Estimated Packages per Shipment	Transport Carrier
Feed	6M	100	uranium oxide (UO_2) powder	10.0*	3 or 13	SST
Fresh Product	Type A-fissile	100	encapsulated	10.0	2 or 37	Commercial Truck
Irradiated Product	Type A-fissile	5	encapsulated	10.0	1	Commercial Truck
	Type B-fissile	95	encapsulated	10.0	2 or 37	Commercial Truck
LLW	Low-Specific Activity (LSA)	0**	bulk; special form	10.0		On-site or Commercial Truck
	Type A	95	various	10.0	72 drums	Commercial Truck
	Type B	5	various	10.0	1	Commercial Truck
TRU	Type A Drum in Type B TRUPACT-II	100		10.0	42	Commercial Truck
Mixed LLW	Type A Drums	100	various	10.0	50	On-site Truck

* Maximum regulatory value used as default.
** No LSA used in analysis, but some Type A LLW could be shipped as LSA.

Stop times associated with transport by SST differ from those for commercial truck transport. Stop time was set at 0.0021 hour per kilometer in accordance with safe operating procedures for the SST (Mulryan, 1987). The value for commercial truck transport is 0.011 hour per kilometer which was used for all other off-site shipments. The operating procedures for the SST are classified.

Representative interstate highway routes from each potential origin to each potential destination were generated by the INTERSTAT routing highway code, which also gives fractions by travel in rural, suburban, and urban population density zones (Cashwell, 1987) and total one-way distance. These are listed in Tables E-20 and E-21.

The INTERSTAT routing network includes the interstate highway system, state-designated alternate routes, and access routes into various DOE facilities. Because of their high and uniform levels of engineering and safety, the interstate highways have been identified by the DOT as the preferred routes for transport of highway-route-controlled quantities of radioactive materials (formerly called large-quantity shipments); where available, urban beltways and bypasses must be used. States and tribes may designate alternative routes when the designation is accompanied by a safety analysis demonstrating equal or greater levels of safety.

The accident rates used in the analysis are from DOT data for the entire commercial shipping industry (i.e., accidents on interstate highways involving at least one commercial tractor-trailer regardless of payload), and are based on millions of total vehicle-kilometers of travel. Available unclassified accident/incident data for radioactive materials shipments indicate, for example, that for the 11-year period from 1971 to 1982, fewer than 30 Type B packages were involved in truck or rail accidents (Wolff, 1984). There was no release of radioactive material in any of these accidents. An accident rate derived from this information should not be used; the statistical significance would be questionable because the total truck-kilometers involved are relatively small and because few accidents occurred. Therefore, the accident rates in this analysis are conservatively set equal to the national average accident rates for commercial tractor-trailers. The national average rates are derived from DOT data and are appropriate for relatively long-distance routes that traverse several states. SNL has conducted a number of tests to demonstrate the validity of this conclusion. The average for the entire United States is 3.1×10^{-7} accidents per kilometer (4.0×10^{-7} accidents per mile). The limited variability in accident rates supports the use of national average data for the program shipments. These accident rates were also used for on-site shipments. This is a conservative approach because lower speeds and institutional controls are expected to lower actual on-site accident rates.

Table E-20. Transportation Quantities and Distances for Proposed Shipments that are Independent of Site Alternatives

Origin	Destination	Material	Number of Shipments	Kilometers per Shipment	Estimated Percent of Travel		
					Rural	Suburban	Urban
Oak Ridge, TN	Lynchburg, VA	Feed	50	526	67.7	31.2	1.1
Lynchburg, VA	Albuquerque, NM	Fresh Product	1	2,731	76	23	1.1
Albuquerque, NM	Lynchburg, VA	Irradiated Product	1	2,731	76	23	1.1
Test Location	Disposal Location	Low Level	3,523*	50	100	0	0

* Includes 11 shipments of mixed waste to on-site mixed-waste-processing facility.

Table E-21. Transportation Quantities and Distances for Site Alternatives

Alternative	Site	Origin	Destination	Material	Estimated Number of Shipments	Kilometers per Shipment	Percent of Travel		
							Rural	Suburban	Urban
1	NTS	Lynchburg, VA	Albuquerque, NM	Fresh Product	83	2,731	76	23	1
		Albuquerque, NM	Mercury, NV	Fresh Product	83	1,043	87	12	1
		Mercury, NV	Albuquerque, NM	Irradiated Product	83	1,043	87	12	1
		Albuquerque, NM	Lynchburg, VA	Irradiated Product	83	2,731	76	23	1
		Mercury, NV	Carlsbad, NM	TRU Waste	1	1,492	87	12	1
2	INEL	Lynchburg, VA	Albuquerque, NM	Fresh Product	83	2,731	76	23	1
		Albuquerque, NM	Idaho Falls, ID	Fresh Product	83	1,801	87	12	1
		Idaho Falls, ID	Albuquerque, NM	Irradiated Product	83	1,801	87	12	1
		Albuquerque, NM	Lynchburg, VA	Irradiated Product	83	2,731	76	23	1
		Idaho Falls, ID	Carlsbad, NM	TRU Waste	1	2,250	87	12	1

• On-site transportation of LLW is assumed to be 50 kilometers (30 miles) for all sites. Transport quantities and distances are shown in Table E-20.

These rates are for all reported combination truck accidents on interstate highways. The possibility of the very severe accidents which would be required to result in a release of radioactive material is much lower. The overall frequency of under-reporting of accidents is about 40 percent for property-damage-only accidents; the reporting of serious and fatal accidents is virtually 100 percent (Smith and Wilmot, 1982). Thus, the base accident rate is not adjusted for under-reporting, since doing so would serve only to raise the relative frequency of occurrence of low-severity accidents and lower the relative frequency of occurrence of high-severity accidents, which would remove a certain level of conservatism in the accident-risk calculation. The eight-category Accident Severity Category matrix for commercial truck transport from NUREG-0170 (Nuclear Regulatory Commission [NRC], 1977) is used.

Restricting truck transport to good weather conditions reduces the overall truck accident rate by about 10 percent (NUREG-0170 Section 6.3.3). Since accidents associated with travel in poor weather conditions are included in the DOT accident-rate data that were used in the risk analysis, the risk estimate is slightly conservative with respect to this parameter. In the unlikely event of an unforeseen road closure, radiological impacts would be associated mainly with an increase in stop time and perhaps an increase/decrease in distance traveled (e.g., if a vehicle were able to use an alternate route). Since only a few shipments at most would be affected on an annual basis, the overall annual incident-free risk estimate would not change significantly.

The SST would be used to transport program-related shipments of feed material. An SST may be, but was not assumed to be, used for fresh and irradiated product shipments. The SST acts as a significant secondary barrier; it provides additional shielding that reduces the external dose rate of the shipments, and it provides additional levels of accident resistance. For shipments of TRU waste to the WIPP, the TRUPACT-II package would be used. Release fractions for a typical Type B package were used (NRC, 1977) to represent the TRUPACT-II, and no credit was taken for any protection that might be afforded by the inner Type A packages (drum). The LLW low-specific activity and Type A packages were modeled as typical Type A packages.

The 6M is one of the few packagings for which a large amount of data exists on response to the higher severity category accidents, and the release fraction values used here and in earlier studies are based on these data (Bonzon, 1977; Fischer et al., 1987). It is expected that the 6M will be replaced by a newer packaging of the same type with an improved closure mechanism. However, other basic features of the packaging would remain the same, and the new Type B inner packaging is modelled in this analysis as having the same properties as a 6M. The accident resistance provided by the SST is significant. The high integrity of the trailer acts as an impact-

force-reducing barrier and provides thermal protection. The release fractions assigned to the Type B packaging in Accident Severity Categories VI, VII, and VIII for the 6M inner packaging must be modified to reflect the protection afforded a shipment by the SST. Lesser accident categories (I through V) result in no release of material to the environment (NRC, 1977).

The SST also provides enhanced thermal protection, being capable of withstanding temperatures in excess of the regulatory test-fire temperature [1,475° F (800° C)] for periods exceeding the test duration of 30 minutes without significant elevation of internal temperature (SNL, 1976). The SST provides additional thermal protection such that the Type B packagings, which are themselves highly fire-resistant, would not directly experience thermal loads characteristic of a Category VI fire. Note that both fire and impact forces of the magnitudes defined above are required for an accident to be classified as Accident Severity Category VI; this is also true of the definitions of Categories VII and VIII. The SST so effectively prevents either of these conditions from affecting the payload that a Category VI accident would not result in any release of contents. Therefore, the release fraction for this severity category is equal to zero for shipments of the Type B/SST configuration. For shipments of the Type A/SST configuration, the release fraction for Category VI was set equal to 0.01. Since Type A packages subject to severe impact loadings encountered in Categories VII and VIII must be assumed to fail completely, the SST was conservatively modeled as providing no additional protection in these two highest categories.

The forces a shipment may experience in Category VII accidents [140,000-230,000 kilograms (300,000-500,000 pounds)], if applied uniformly to the SST, would not result in crush forces in the interior of the trailer that exceeded the Type B failure threshold. However, concentrated application of such forces could cause local deformation of the SST. Crush forces on packagings in the immediate vicinity of the impact point could exceed the Type B threshold. Forces of that magnitude are seldom encountered in actual accidents. A grade-crossing accident involving a train moving at high velocity could conceivably provide the requisite force at a 90-degree impact angle, and the force would be concentrated in a relatively small area rather than being uniformly distributed. Therefore, for the purposes of this study, all accidents of this severity are modeled conservatively as being of the local-deformation type. For a close-packed array of Type B packages, four packages in the immediate vicinity of the local deformation would be affected. The four packages damaged by crush forces generated as a result of impact could be subjected to a Category VII fire (800° C [1,475°F] for up to 2 hours) and could release some fraction of their contents. The release fraction for each shipment was then conservatively set equal to the product of the fraction of affected Type Bs and the release fraction for a Type B in a Category VII accident (as defined in NUREG-0170 using Model II). For SSTs carrying Type A packages, all Type A packages were modeled as failing completely in a hypothetical Category VII.

Accident Severity Category VIII, as defined in NUREG-0170 (NRC, 1977) for highway transport, includes accidents involving both forces greater than 230,000 kilograms (500,000 lbs) and fires over 2 hours in duration at 800° C (1,475°F) (or equivalent thermal load). No highway accident this severe has ever been recorded, so for the purposes of this study the local-deformation scenario used in Category VII was extended. Six Type Bs would be damaged as a result and subjected to fire. The shipment release fraction is again conservatively set equal to the product of the fraction of affected Type Bs and the release fraction for a Type B package in a Category VIII accident (as defined in NUREG-0170). For SSTs carrying Type A packages, all Type A packages were modeled as failing completely in a hypothetical Category VIII accident.

Aerosol and respirable aerosol fraction values for dispersibility category 5 (loose, small powder) are used for feed material (NRC, 1977). They determine the amounts of material that may be dispersed and eventually inhaled in each severity category in which a release may occur. The fraction of airborne material that is less than 10 microns in size (mean aerodynamic diameter) and that could therefore enter the human respiratory system (International Commission on Radiological Protection [ICRP], 1979) was set at 50 percent for feed. Ninety percent (mass percentage) of all inhaled airborne particles between 10 and 20 microns (mean aerodynamic diameter) and 100 percent of all particles over 20 microns (mean aerodynamic diameter) are deposited in the nasopharyngeal region. Respirable aerosols may be generated by impact forces and, more importantly, by fire. The uranium oxide, although it will not burn, is more dispersible when in powder form, and this was accounted for in the analysis by the dispersability category assignment. The respirable aerosols potentially generated in severe accidents are, therefore, estimated in a conservative, material-specific manner. The deposition velocity of all released particulates was set at the default value of 0.03 feet per second (0.01 meters per second), which is representative of aerosols. The fraction of all radionuclides that would be deposited on agricultural land and then transferred to food products was set equal to 2.8×10^{-6} (Ostmeyer, 1986).

The fresh product is a very high integrity material. Even under very severe mechanical and thermal loadings to the fresh product package, more than 99 percent of the material would remain intact. Therefore, aerosol and respirable aerosol fraction values for a similar high-integrity material (Fort St. Vrain power reactor fuel) are used for fresh product. The irradiated product is also assigned aerosol and respirable aerosol fraction values like those used for Fort St. Vrain power reactor spent fuel.

Aerosol and respirable aerosol fractions similar to those used for ordinary commercial shipments of Type A packages are used for low-level waste, and TRU waste is modeled as described in the WIPP SEIS. These values are

typically used in RADTRAN evaluations of the shipment of these materials for environmental evaluations.

For this analysis, RADTRAN results are given in terms of population dose (i.e., person-rem) per shipment. To obtain risk in terms of health effects, these values are multiplied by the total number of shipments of the appropriate material type and by health effect estimators discussed in a BEIR model. The effective whole-body doses calculated by RADTRAN were reduced by a factor of 2 to yield gonadal dose for genetic risks as suggested by the ICRP (ICRP, 1979).

3.3 RESULTS

Radiological unit-risk factors from the RADTRAN System are expressed in units of expected dose (person-rem) and health effects (cancer deaths and genetic effects) per shipment for each type of shipment. Risk factors are calculated separately for the public under incident-free and accident conditions. The representation of each of the three population zones (rural, suburban, and urban) is indicated in the route data given in Tables E-20 and E-21.

Nonradiological risks are deaths arising from traffic accidents (mechanical injuries) and deaths from respiratory ailments resulting from vehicular air pollution (Rao et al., 1981). Nonradiological unit-risk factors based on national statistics were obtained from DOT data.

In this analysis, the entire package dose rate was modeled as gamma radiation, which tends to overestimate total integrated dose because neutrons are rapidly attenuated in air whereas gamma radiation is not. Since the exact packaging configuration to be used has not been identified, the Transport Index (TI) was assumed to be the maximum value allowable for these shipments. This results in a very conservative estimate of radiation doses for incident-free shipments. Typically, the surface dose rates on SNTP packages shipped over public highways will be very low (since many are unirradiated materials) and realistically could be orders of magnitude lower than were assumed for these transportation impact calculations. Consequently, the incident-free radiological impacts should be much lower than those calculated.

The per-shipment risk values are multiplied by the expected number of shipments of each material type to give total risks for each. The per-shipment and total radiological risks for transporting feed, fresh product, irradiated product, material for recycle, and TRU waste are given in Tables E-22 and E-23, respectively. The number of genetic effects is less than 30 percent of the number of cancer deaths shown in these tables. The risk to the public from transportation of low-level and hazardous wastes that are to be treated and disposed of on-site is negligible. Total radiological

Table E-22. Radiological Transportation Risk (person-rem per shipment)
Page 1 of 2

Shipment Type	Route	Person-rem/shipment	
		Incident-Free*	Accident
Fresh Prod 2-element	Lynchburg-NTS	7.91×10^{-1}	1.68×10^{-12}
	Lynchburg-INEL	9.44×10^{-1}	1.90×10^{-12}
Fresh Prod 37-element	Lynchburg-NTS	7.91×10^{-1}	3.12×10^{-12}
	Lynchburg-INEL	9.44×10^{-1}	3.53×10^{-12}
Feed	ORNL-Lynchburg	1.16×10^{-1}	2.94×10^{-8}
Irradiated Product 2-element	NTS-Lynchburg	4.01×10^{-1}	5.21×10^{-6}
	INEL-Lynchburg	4.78×10^{-1}	5.88×10^{-6}
Irradiated Product 37-element	NTS-Lynchburg	4.01×10^{-1}	9.61×10^{-5}
	INEL-Lynchburg	4.78×10^{-1}	1.09×10^{-4}
Experimental Product 4 kg	ALBQ-Lynchburg	2.09×10^{-1}	4.78×10^{-12}

* Based on TI = 10 for all shipments.

Table E-22. Radiological Transportation Risk (person-rem per shipment)
Page 2 of 2

Shipment Type	Route	Person-rem/shipment Incident-Free*	Person-rem/shipment Accident
Low-Level Wastes:			
Concrete & Steel	NTS-NTS	2.00×10^{-3}	2.16×10^{-12}
	INEL-INEL	2.00×10^{-3}	2.16×10^{-12}
Aluminum	NTS-NTS	2.00×10^{-3}	7.87×10^{-14}
	INEL-INEL	2.00×10^{-3}	7.87×10^{-14}
ETS-filters	NTS-NTS	2.00×10^{-3}	3.53×10^{-12}
	INEL-INEL	2.00×10^{-3}	3.53×10^{-12}
ETS-gravel	NTS-NTS	2.00×10^{-3}	4.71×10^{-13}
	INEL-INEL	2.00×10^{-3}	4.71×10^{-13}
ETS-silica	NTS-NTS	2.00×10^{-3}	4.71×10^{-13}
	INEL-INEL	2.00×10^{-3}	4.71×10^{-13}
ETS-struct	NTS-NTS	2.00×10^{-3}	2.72×10^{-11}
	INEL-INEL	2.00×10^{-3}	2.72×10^{-11}
Copper	NTS-NTS	2.00×10^{-3}	1.33×10^{-8}
	INEL-INEL	2.00×10^{-3}	1.33×10^{-8}
Beryllium	NTS-NTS	2.00×10^{-3}	2.75×10^{-15}
	INEL-INEL	2.00×10^{-3}	2.75×10^{-15}
Graphite	NTS-NTS	2.00×10^{-3}	5.95×10^{-19}
	INEL-INEL	2.00×10^{-3}	5.95×10^{-19}
Low-Level ETS Waste:			
ZiC-Graph	NTS-NTS	2.00×10^{-3}	1.60×10^{-13}
	INEL-INEL	2.00×10^{-3}	1.60×10^{-13}
Aluminum	NTS-NTS	2.00×10^{-3}	5.05×10^{-10}
	INEL-INEL	2.00×10^{-3}	5.05×10^{-10}
Structural	NTS-NTS	2.00×10^{-3}	5.06×10^{-10}
	INEL-INEL	2.00×10^{-3}	5.06×10^{-10}
TRU Waste:			
TRU	NTS-WIPP	8.49×10^{-3}	1.74
	INEL-WIPP	1.28×10^{-2}	2.62
Mixed Waste:			
Mixed	NTS-NTS	9.82×10^{-3}	1.24×10^{-6}
	INEL-INEL	9.82×10^{-3}	1.24×10^{-6}

* Based on TI = 10 for all shipments.

Table E-23. Total Radiological Transportation Risks
(person-rem)
Page 1 of 2

Shipment Type	Route	Shipment Number	Incident-Free*	Accident
Fresh Prod (2-element)	Lynchburg-NTS	80	6.31×10^{1}	1.35×10^{-10}
	Lynchburg-INEL	80	7.55×10^{1}	1.52×10^{-10}
Fresh Prod (37-element)	Lynchburg-NTS	3	2.37×10^{0}	9.36×10^{-11}
	Lynchburg-INEL	3	2.83×10^{0}	1.06×10^{-10}
Feed	ORNL-Lynchburg	50	5.80×10^{0}	1.47×10^{-8}
Irradiated Product (2-element)	NTS-Lynchburg	80	3.21×10^{1}	4.17×10^{-4}
	INEL-Lynchburg	80	3.82×10^{1}	4.70×10^{-4}
Irradiated Product (37-element)	NTS-Lynchburg	3	1.20×10^{0}	2.89×10^{-4}
	INEL-Lynchburg	3	1.43×10^{0}	3.27×10^{-4}
Experimental Product 4 kg	ALBQ-Lynchburg	1	2.09×10^{-1}	4.78×10^{-12}
Low-Level Wastes:				
Concrete & Steel	NTS-NTS	612	1.22×10^{0}	1.32×10^{-9}
	INEL-INEL	612	1.22×10^{0}	1.32×10^{-9}
Aluminum	NTS-NTS	148	2.96×10^{-1}	1.17×10^{-11}
	INEL-INEL	148	2.96×10^{-1}	1.17×10^{-11}
ETS-filters	NTS-NTS	143	2.86×10^{-1}	5.05×10^{-10}
	INEL-INEL	143	2.86×10^{-1}	5.05×10^{-10}
ETS-gravel	NTS-NTS	143	2.86×10^{-1}	6.74×10^{-11}
	INEL-INEL	143	2.86×10^{-1}	6.74×10^{-11}

* Based on TI = 10 for all shipments.

Table E-23. Total Radiological Transportation Risks
(person-rem)
Page 2 of 2

Shipment Type	Route	Shipment Number	Incident-Free*	Accident
ETS-silica	NTS-NTS	143	2.86×10^{-1}	6.74×10^{-11}
	INEL-INEL	143	2.86×10^{-1}	6.74×10^{-11}
ETS-struct	NTS-NTS	2319	4.64×10^{0}	6.31×10^{-8}
	INEL-INEL	2319	4.64×10^{0}	6.31×10^{-8}
Copper	NTS-NTS	1	2.00×10^{-3}	1.33×10^{-8}
	INEL-INEL	1	2.00×10^{-3}	1.33×10^{-8}
Graphite	NTS-NTS	1	2.00×10^{-3}	5.95×10^{-19}
	INEL-INEL	1	2.00×10^{-3}	5.95×10^{-19}
Low-Level ETS Waste:				
ZiC-Graph	NTS-NTS	1	1.98×10^{-3}	1.60×10^{-13}
	INEL-INEL	1	1.98×10^{-3}	1.60×10^{-13}
Aluminum	NTS-NTS	1	1.98×10^{-3}	5.05×10^{-10}
	INEL-INEL	1	1.98×10^{-3}	5.05×10^{-10}
Structural	NTS-NTS	1	1.98×10^{-3}	5.06×10^{-10}
	INEL-INEL	1	1.98×10^{-3}	5.06×10^{-10}
Beryllium	NTS-NTS	1	2.00×10^{-3}	2.75×10^{-15}
	INEL-INEL	1	2.00×10^{-3}	2.75×10^{-16}
TRU Waste:				
TRU	NTS-WIPP	1	8.49×10^{-3}	1.74×10^{-10}
	INEL-WIPP	1	1.28×10^{-2}	2.62×10^{-10}
Mixed Waste:				
Mixed	NTS-NTS	11	1.08×10^{-1}	1.36×10^{-4}
	INEL-INEL	11	1.08×10^{-1}	1.36×10^{-4}

* Based on TI = 10 for all shipments.

risks for the NTS and INEL alternatives are given in Tables E-24 and E-25. The total nonradiological risk of an accident-related fatality is 0.200 for NTS and 0.231 for INEL. Total nonradiological transportation risks are given in Table E-26.

Table E-27 is a summary of total radiological and non-radiological risks for all materials that includes the risks for both incident-free conditions and the accident conditions. The radiological risks of transportation result mainly from the transport of fresh product. Most of the radiological risk is attributable to incident-free transport. That is, potential accidents contribute little to the total radiological risks. Nonradiological risks are about 2 times higher than radiological risks and would result from mechanical injuries from traffic accidents. Using a more realistic assumption on Transport Index (TI) in the RADTRAN calculations would result in the non-radiological risk remaining the same and the radiological risk being much smaller. The predicted number of traffic accident fatalities of 0.200 to 0.231 is very small in comparison with the thousands of traffic deaths on American highways each year.

4.0 ON-SITE CONTAMINATION

4.1 DISTRIBUTION OF CORE CONTENTS FOLLOWING HYDROGEN EXPLOSION

As discussed in Section 4.12.2.1, hydrogen explosions are not capable of damaging the reactor vessel such that fuel particles could be released and dispersed. However, to assess the potential impacts of contaminating areas near the proposed test facility, the dispersal of fuel particles by a hydrogen explosion has been analyzed where the fuel particles have arbitrarily been assumed to be placed within the exploding hydrogen/air mixture.
Two mechanisms are available for dispersing the core particles: ballistic flight from shock-imparted momentum, and lofting by fireball winds. The latter was determined to be the most important because particle deceleration in the former case is governed by the particle relaxation time which is short compared with the time for fireball rise.

The approach to determining particle distribution involved performing a hydrodynamic cloud rise calculation to model the rise of a hot gas bubble that is grossly consistent with the fireball produced from a hydrogen/air detonation. The calculation was done in a manner that was consistent with the following assumptions:

1. The hydrogen/air detonation involved 30,000 gallons of liquid hydrogen that somehow became stoichiometrically mixed with air and detonated. The detonation involved an energy release of 1.61×10^{12} Joules; some time after detonation, the fireball was a surface hemisphere with a radius of approximately 130 meters and a temperature of approximately 1,000 K. The hydrodynamic calculation was initialized at this time

Table E-24. Radiological Transportation Risks for NTS Alternative
Page 1 of 2

Alternative	Dose in Person-rem Incident-Free**	Dose in Person-rem Accident	LCFs* Incident-Free	LCFs* Accident
Fresh Prod (2)[a]	6.31×10^{1}	1.35×10^{-10}	4.98×10^{-2}	1.07×10^{-13}
Fresh Prod (37)[b]	2.37×10^{0}	9.36×10^{-11}	1.88×10^{-3}	7.39×10^{-14}
Fresh Prod Total	6.55×10^{1}	2.29×10^{-10}	5.17×10^{-2}	1.80×10^{-13}
Feed:ORNL-Lynch	5.80×10^{0}	1.47×10^{-6}	4.58×10^{-3}	1.16×10^{-9}
Irrad Prod (2)	3.21×10^{1}	4.17×10^{-4}	2.54×10^{-2}	3.30×10^{-7}
Irrad Prod (37)	1.20×10^{0}	2.89×10^{-4}	9.48×10^{-4}	2.29×10^{-7}
Irrad Prod Total	3.33×10^{1}	7.06×10^{-4}	2.54×10^{-2}	5.59×10^{-7}
Experimental Product	2.09×10^{-1}	4.78×10^{-12}	1.66×10^{-4}	3.78×10^{-15}
LLW:				
Concrete & Steel	1.22×10^{0}	1.32×10^{-9}	9.64×10^{-4}	1.04×10^{-12}
Aluminum	2.96×10^{-1}	1.17×10^{-11}	2.34×10^{-4}	9.24×10^{-15}
ETS-filters	2.86×10^{-1}	5.05×10^{-10}	2.26×10^{-4}	4.00×10^{-14}
ETS-gravel	2.86×10^{-1}	6.74×10^{-11}	2.26×10^{-4}	5.32×10^{-14}
ETS-silica	2.86×10^{-1}	6.74×10^{-11}	2.26×10^{-4}	5.32×10^{-14}
ETS-struct-1	4.64×10^{0}	6.31×10^{-8}	3.67×10^{-3}	4.99×10^{-11}
Copper	2.00×10^{-3}	1.33×10^{-8}	1.58×10^{-6}	1.05×10^{-11}
Graphite	2.00×10^{-3}	5.95×10^{-19}	1.58×10^{-6}	4.71×10^{-22}
ETS-struct-2***	1.98×10^{-3}	5.06×10^{-10}	1.56×10^{-6}	4.00×10^{-13}
Beryllium***	2.00×10^{-3}	2.75×10^{-15}	1.58×10^{-6}	2.18×10^{-18}
LLW Total	7.02×10^{0}	7.78×10^{-8}	5.55×10^{-3}	6.19×10^{-11}

* Conversion factor = 7.9×10^{-4} LCF/person-rem (BEIR V).
** Based on package dose rate (TI) = 10 as default.
*** Originally treated as high-activity waste but evaluation indicates that material is LLW.
(a) 2 = 2 element
(b) 37 - 37-element

Table E-24. Radiological Transportation Risks for NTS Alternative
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Alternative	Dose in Person-rem Incident-Free**	Dose in Person-rem Accident	LCFs* Incident-Free	LCFs* Accident
Low-Level ETS Waste:				
ZiC-Graphite	1.98×10^{-3}	1.60×10^{-13}	1.56×10^{-6}	1.26×10^{-16}
Aluminum	1.98×10^{-3}	5.05×10^{-10}	1.56×10^{-6}	4.00×10^{-14}
High-Activity Total	3.96×10^{-3}	5.05×10^{-10}	3.12×10^{-6}	4.00×10^{-14}
TRU Waste:	8.49×10^{-3}	1.74×10^{-10}	6.71×10^{-6}	1.37×10^{-13}
Mixed Waste:	1.08×10^{-1}	1.36×10^{-4}	8.53×10^{-5}	1.07×10^{-7}
Total	1.12×10^{2}	8.44×10^{-4}	8.76×10^{-2}	6.66×10^{-7}

* Conversion factor = 7.9×10^{-4} LCF/person-rem (BEIR V).
** Based on package dose rate (TI) = 10 as default.
*** Originally treated as high-activity waste but evaluation indicates that material is LLW.

Table E-25. Radiological Transportation Risks for INEL Alternative
Page 1 of 2

Alternative	Dose in Person-rem: Incident-Free**	Dose in Person-rem: Accident	LCFs*: Incident-Free	LCFs*: Accident
Fresh Prod (2)	7.55×10^{1}	1.52×10^{-10}	5.97×10^{-2}	1.20×10^{-13}
Fresh Prod (37)	2.83×10^{0}	1.06×10^{-10}	2.24×10^{-3}	8.37×10^{-14}
Fresh Prod Total	7.83×10^{1}	2.58×10^{-10}	6.19×10^{-2}	2.04×10^{-13}
Feed:ORNL-Lynch	5.80×10^{0}	1.47×10^{-6}	4.58×10^{-3}	1.16×10^{-9}
Irrad Prod (2)	3.82×10^{1}	4.70×10^{-4}	3.02×10^{-2}	3.71×10^{-7}
Irrad Prod (37)	1.43×10^{0}	3.27×10^{-4}	1.13×10^{-3}	2.59×10^{-7}
Irrad Prod Total	3.96×10^{1}	7.97×10^{-4}	3.13×10^{-2}	6.3×10^{-7}
Experimental Product	2.90×10^{-1}	4.78×10^{-12}	1.66×10^{-4}	3.78×10^{-15}
LLW:				
Concrete & Steel	1.22×10^{0}	1.32×10^{-9}	9.64×10^{-4}	1.04×10^{-12}
Aluminum	2.96×10^{-1}	1.17×10^{-11}	2.34×10^{-4}	9.24×10^{-15}
ETS-filters	2.86×10^{-1}	5.05×10^{-10}	2.26×10^{-4}	4.00×10^{-14}
ETS-gravel	2.86×10^{-1}	6.74×10^{-11}	2.26×10^{-4}	5.32×10^{-14}
ETS-silica	2.86×10^{-1}	6.74×10^{-11}	2.26×10^{-4}	5.32×10^{-14}
ETS-struct-1	4.64×10^{0}	6.31×10^{-8}	3.67×10^{-3}	4.99×10^{-11}
Copper	2.00×10^{-3}	1.33×10^{-8}	1.58×10^{-6}	1.05×10^{-11}
Graphite	2.00×10^{-3}	5.95×10^{-19}	1.58×10^{-6}	4.71×10^{-22}
ETS-struct-2***	1.98×10^{-3}	5.06×10^{-10}	1.56×10^{-6}	4.00×10^{-13}
Beryllium***	2.00×10^{-3}	2.75×10^{-15}	1.58×10^{-6}	2.18×10^{-18}
LLW Total	7.02×10^{0}	7.78×10^{-8}	5.55×10^{-3}	6.19×10^{-11}

* Conversion factor = 7.9×10^{-4} LCF/person-rem (BEIR V).
** Based on package dose rate (TI) = 10 as default.
*** Originally treated as high-activity waste but evaluation indicates that material is LLW.

Table E-25. Radiological Transportation Risks for INEL Alternative
Page 2 of 2

Alternative	Dose in Person-rem		LCFs*	
	Incident-Free**	Accident	Incident-Free	Accident
Low-Level ETS Waste:				
ZiC-Graphite	1.98×10^{-3}	1.60×10^{-13}	1.56×10^{-6}	1.26×10^{-16}
Aluminum	1.98×10^{-3}	5.05×10^{-10}	1.56×10^{-6}	4.00×10^{-14}
High-Activity Total	3.96×10^{-3}	5.05×10^{-10}	3.12×10^{-6}	4.00×10^{-14}
TRU Waste:	1.28×10^{-2}	2.62×10^{-10}	1.01×10^{-6}	2.07×10^{-13}
Mixed Waste:	1.08×10^{-1}	1.36×10^{-4}	8.53×10^{-5}	1.07×10^{-7}
Total	1.31×10^{2}	9.33×10^{-4}	1.03×10^{-1}	7.38×10^{-7}

* Conversion factor = 7.9×10^{-4} LCF/person-rem (BEIR V).
** Based on package dose rate (TI) = 10 as default.
*** Originally treated as high-activity waste but evaluation indicates that material is LLW.

Table E-26. Nonradiological Transportation Risks (fatalities) Page 1 of 2

Type	Route	Shipment Number	Fatalities/ One-way trip	Total
Fresh Prod (2) via ALBQ	Lynchburg-NTS	80	4.39×10^{-4}	7.02×10^{-2}
	Lynchburg-INEL	80	5.33×10^{-4}	8.52×10^{-2}
Fresh Prod (37) via ALBQ	Lynchburg-NTS	3	4.39×10^{-4}	2.64×10^{-3}
	Lynchburg-INEL	3	5.33×10^{-4}	3.20×10^{-3}
Feed	ORNL-Lynchburg	50	5.52×10^{-5}	5.52×10^{-3}
Irradiated Product (2) via ALBQ	NTS-Lynchburg	80	4.39×10^{-4}	7.02×10^{-2}
	INEL-Lynchburg	80	5.33×10^{-4}	8.52×10^{-2}
Irradiated Product (37) via ALBQ	NTS-Lynchburg	3	4.39×10^{-4}	2.64×10^{-3}
	INEL-Lynchburg	3	5.33×10^{-4}	3.20×10^{-3}
Experimental Product 4 kg	ALBQ-Lynchburg	1	3.10×10^{-4}	6.20×10^{-4}
Low Level Wastes:				
Concrete & Steel	NTS-NTS	612	6.80×10^{-6}	8.22×10^{-3}
	INEL-INEL	612	6.80×10^{-6}	8.32×10^{-3}
Aluminum	NTS-NTS	148	6.80×10^{-6}	2.02×10^{-3}
	INEL-INEL	148	6.80×10^{-6}	2.02×10^{-3}
ETS-filters	NTS-NTS	143	6.80×10^{-6}	1.94×10^{-3}
	INEL-INEL	143	6.80×10^{-6}	1.94×10^{-3}
ETS-gravel	NTS-NTS	143	6.80×10^{-6}	1.94×10^{-3}
	INEL-INEL	143	6.80×10^{-6}	1.94×10^{-3}

Table E-28. Nonradiological Transportation Risks (fatalities) Page 2 of 2

Type	Route	Shipment Number	Fatalities/ One-way trip	Total
Low-Level Wastes (cont'd):				
ETS-silica	NTS-NTS	143	6.80×10^{-6}	1.94×10^{-3}
	INEL-INEL	143	6.80×10^{-6}	1.94×10^{-3}
ETS-struct	NTS-NTS	2319	6.80×10^{-6}	3.16×10^{-2}
	INEL-INEL	2319	6.80×10^{-6}	3.16×10^{-2}
Copper	NTS-NTS	1	6.80×10^{-6}	1.36×10^{-5}
	INEL-INEL	1	6.80×10^{-6}	1.36×10^{-5}
Graphite	NTS-NTS	1	6.80×10^{-6}	1.36×10^{-5}
	INEL-INEL	1	6.80×10^{-6}	1.36×10^{-5}
Low-Level ETS Waste:				
ZiC-Graph	NTS-NTS	1	6.80×10^{-6}	1.36×10^{-5}
	INEL-INEL	1	6.80×10^{-6}	1.36×10^{-5}
Aluminum	NTS-NTS	1	6.80×10^{-6}	1.36×10^{-5}
	INEL-INEL	1	6.80×10^{-6}	1.36×10^{-5}
Structural	NTS-NTS	1	6.80×10^{-6}	1.36×10^{-5}
	INEL-INEL	1	6.80×10^{-6}	1.36×10^{-5}
Beryllium	NTS-NTS	1	6.80×10^{-6}	1.36×10^{-5}
	INEL-INEL	1	6.80×10^{-6}	1.36×10^{-5}
TRU Waste:				
TRU	NTS-WIPP	1	1.85×10^{-4}	3.70×10^{-4}
	INEL-WIPP	1	2.79×10^{-4}	5.58×10^{-4}
Mixed Waste:				
Mixed	NTS-NTS	11	6.80×10^{-6}	1.50×10^{-4}
	INEL-INEL	11	6.80×10^{-6}	1.50×10^{-4}

Table E-27. Total Transportation Risks

Alternative	Estimated Nonradiological Fatalities		
NTS	0.200		
INEL	0.231		
	Estimated Radiological Risk		
	Person-rem	LCFs**	Genetic Effects*
NTS			
Incident-free	1.12×10^{2}	8.85×10^{-2}	2.35×10^{-2}
Accident	8.44×10^{-4}	6.67×10^{-7}	1.77×10^{-7}
INEL			
Incident-free	1.31×10^{2}	1.03×10^{-1}	2.75×10^{-2}
Accident	9.33×10^{-4}	7.37×10^{-7}	1.96×10^{-7}

* Based on 2.1×10^{-4} genetic effects/person-rem.
** Latent cancer fatalities.

2. The initial velocity field generated by the explosion was ignored. It was assumed that the final rise was governed by the total thermal energy content of the fireball, not its initial distribution

3. The fuel particles were initially uniformly distributed within the fireball

4. Fuel particle motion dynamics were similar to those of a sphere 5 *millimeters in diameter* with a density of 6 grams per cubic meters. Fluid conditions for the drag equations were obtained from the hydrodynamic solution.

The maximum height of the cloud center of mass was approximately 900 meters and was attained 2 minutes after the detonation. The maximum height obtained by a fuel particle was approximately 3.2 kilometers. The maximum radius was approximately 600 meters.

The settling velocity of the fuel particles is approximately 5 meters per second. Assuming downwind transport of 5.5 meters per second and free fall conditions subsequent to the rise (no turbulence effects), the footprint dimensions are estimated as:

center of mass range:	1.6 kilometers
maximum range:	5.2 kilometers
maximum width:	1.2 kilometers

Since the center of mass radius is considerably less than the maximum, the distribution of the fuel particles within the footprint is expected to be peaked in the crosswind direction.

The above analysis provides a rough estimate of the fuel particle footprint resulting from a hydrogen explosion and should not be given undue credit. The significant result is that the winds subsequent to a hydrogen explosion are sufficient to loft fuel particles if they somehow become entrained in the flow. The contamination from such an accident is expected to remain on station.

4.2 CONTAMINATION CONSEQUENCES

Calculations have been performed to determine the dose received from soil contamination assuming the entire source term is placed on the ground. These calculations have been done following guidance in DOE Order 5400.5, Chapter 4, where the dose received from soil contamination is given as 100 mrem/year. If the effective dose from soil contamination is less than this value, no restriction is placed on the land. Two pathways have been included in the dose calculations: direct dose from soil contamination, and dose from resuspension inhalation. The ingestion pathway has not been included in this analysis, since it is highly unlikely that anyone will be permitted to farm and live on either the SMTS or CTF sites in the foreseeable future (50 years). Should a major accident occur, this may require long-term restrictions on some land now open (under permit) for grazing at INEL. Due to these restrictions, the doses from these calculations represent on-site worker doses if workers are allowed to stay on contaminated ground.

The maximum credible accident that resulted in the greatest consequences to the public and on-site workers was primarily an airborne gaseous release. This would not result in significant ground contamination. A Consequence I-type accident would result in the greatest amount of ground contamination but no mechanism to achieve such a 100 percent release could be identified. Although such an accident is not credible, it is presented as the maximum hypothetical ground contamination impact. Results of a 5 percent release are also presented. While even a 5 percent value is expected to be a conservative overestimate of consequences, it comes closer to a credible estimate. The calculation of effective dose equivalents from ground contamination for these source terms includes both noble gases and particulate matter. This is conservative in that noble gases will actually be carried away rather than deposited on the ground. Results of this analysis have been used to determine the length of time following release in which

dose rates exceed 100 mrem per year. These results are presented in Table E-28.

Table E-28. Effective Restricted Use Time (years)

Area (km^2)	Consequence I	5% Consequence I
1	>50.0	9.8
10	34.0	5.0
100	7.4	0.73
1,000	0.84	0.10
10,000	0.35	<8 hours

In the case of ground contamination, the results of these calculations can be used to assess whether cleanup is necessary or whether the land can be fenced and posted and the activity allowed to decay to acceptable levels. Note that no ground contamination is expected as a result of normal operations, rather, the consequences described here are the result of a beyond-maximum-case accident. Actual accident impacts can be expected to be much smaller.

5.0 BOUNDING ENERGETIC ACCIDENT

5.1 INTRODUCTION

The accident which would result in the largest energy release in the form of a blast wave involves the combustion of hydrogen stored on station. Liquid and gaseous hydrogen are used as both a working fluid for the SNTP system and as a coolant for the ETS. The amount of hydrogen stored on station will depend on the final configuration of the test apparatus. The current estimate for the ground test article (GTA) is 4.88×10^5 kilograms (1,920,000 gallons), with approximately 95 percent being stored in liquid form. The largest container type is expected to be a 1.27×10^4 kilograms (50,000 gallons) cryogenic vessel. An energetic release can produce both fragments and blast overpressure. It is anticipated that, due to the large amount of hydrogen on station, blast overpressure represents the most serious consequences of an energetic event.

For the purpose of determining the consequences of an energetic event, both SMTS and CTF are sufficiently similar that they can be treated as the same except where noted. Using the U.S. Standard Atmosphere (The U.S. Standard Atmosphere, 1962) pressures for altitude, the average pressure is 84.5 kilopascals (kPa). In general, the SMTS at the Nevada Test Site is warmer than INEL, particularly in the winter. Using the Standard

Atmosphere temperatures, the temperature corresponding to 84.5 kPa is 278 Kelvin (K). This temperature is consistent with winter temperatures at the SMTS and spring/fall temperatures at INEL. For this analysis, the pressure is taken as 84.5 kPa and the temperature as 278 K.

The consequences of an energetic event will be somewhat affected by terrain. The SMTS facility differs from the CTF facility in that the SMTS resides in a valley. For blast overpressures, the pressures will be higher on the sides of mountains facing the blast and lower on the sides of mountains facing away from the blast compared with a flat terrain. Studies of acoustic attenuation shows that lower overpressures exist behind barriers extending horizontally about ten barrier heights (Keefer and Day, 1966). Beyond this shadow zone, the overpressures return to that predicted for a flat surface. For this analysis, terrain effects will be ignored at both sites and a flat surface will be assumed to extend in all directions from the site out to the radius in which there are no longer any consequences from blast overpressure.

5.2 ACCIDENTS

Accidents that could result in hydrogen combustion can be initiated in a number of ways. External events, such as a aircraft strike, or internal events, such as an unintentional release, can result in the formation of a hydrogen cloud. In general, hydrogen is lighter than air and will rise away from the source. As such, it is much safer than hydrocarbon gases such as gasoline vapor. However, cryogenic hydrogen is heavier than air until it warms sufficiently. If hydrogen is released, it will mix with the surrounding air. The details of the evolution and mixing process are complex and accident dependent. For this analysis, a cloud is assumed to form along the ground in a cylindrical shape with a radius 5 times the height. The size of the cloud depends on the amount of hydrogen, and will tend to rise on warming. However, from a consequence point of view, the worst case is the formation of a uniform cloud that is stoichiometric, i.e., two parts hydrogen for every part oxygen. For this analysis, it is assumed that a uniform, stoichiometric cloud forms.

If an ignition source is present in a flammable mixture (Kumar, 1985), then combustion will result. The worst case situation from a consequence point of view is if the mode of combustion is detonation. A detonation will convert the highest fraction of chemical energy to directed kinetic energy (blast overpressure). For this analysis, it is assumed that the cloud detonates.

Two cases will be considered. The first case is the failure of a single vessel and the subsequent detonation of the cloud. This accident is considered credible but the analysis is an upper bound for the accident. The resulting overpressures will very likely be lower than those presented below. For this

case, the hydrogen-air cloud is 20 meters high with a radius of 100 meters and is centrally initiated.

The second case is a common mode failure of all vessels and subsequent detonation of all hydrogen on station. This accident is considered incredible and is included only because it represents an absolute upper bound on the energetic release from a hydrogen combustion accident. For stoichiometric conditions, the resultant cloud would have a radius of 235 meters and be 47 meters high. An accident initiator sufficiently large to cause common mode failure will almost certainly ignite the mixture before it has time to mix to conditions in which a detonation can occur and be sustained.

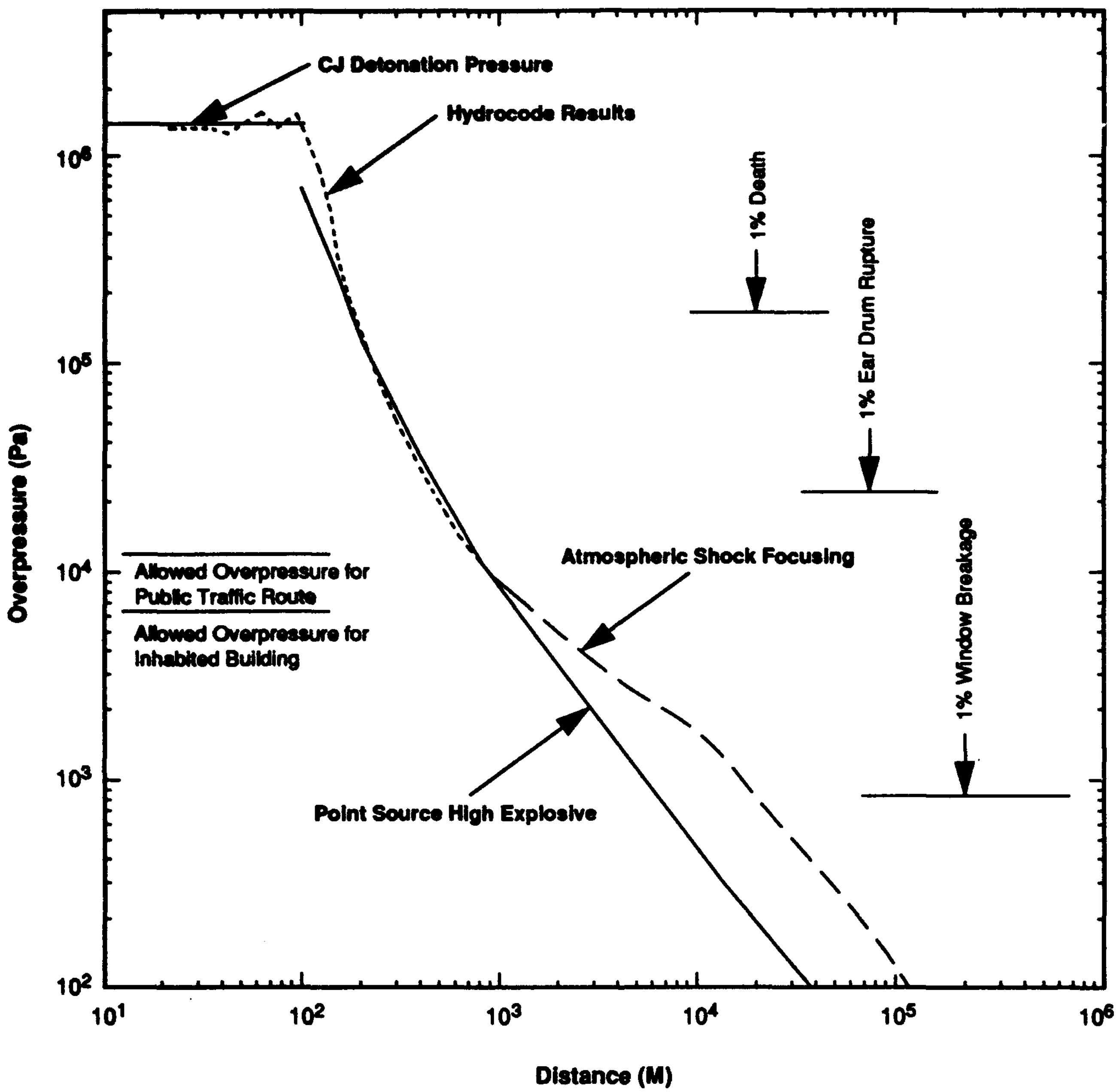
5.3 BLAST OVERPRESSURE MODELS

Figure E-2 shows the overpressure as a function of distance for a single dewar accident. Four models were used to generate the curves shown. The first model is the Chapman-Jouguet (CJ) detonation model. The second model is a hydrocode calculation of a detonating hydrogen-air cloud. The third is a point-source blast (high explosive) model and the fourth is a correlation of atmospheric focusing (caustics) effects. The "side-on" pressure for a detonation wave is given by the CJ pressure (Strehlow, 1984). For this analysis the CJ pressure is 1.4116 MPa as calculated by the McBride code (McBride, 1989).

The hydrocode model used is CTH (McGlaun and Thompson, 1990). The detonation in the cloud is modeled as a CJ detonation. The air is modeled as an ideal gas. No gradients existed in the cloud or the air. The computational grid is axisymmetric, 100 by 400 nodes. The results have been adjusted to match the CJ pressure in the cloud.

For radii farther than a few cloud diameters, the energy release from the gaseous detonation can (to a first order) be approximated as a point-source high explosive of the same energy content. Using a value of 120 MJ/kg for the heat of combustion of hydrogen and a value of 4.27 MJ/kg for a heat of detonation for TNT, the amount of TNT required to produce the same blast energy as hydrogen is 28:1. For the single dewar failure, this amounts to 3.55×10^6 kilograms (approximately 5.4 kilotons) TNT equivalent. Standard overpressure vs. distance curves are available for blast overpressure from a surface burst of TNT. The curves can be scaled to the amount of high explosive by the (charge weight) 1/3 scaling law (Baker, 1983). For this analysis, the point-source curve in Figure E-2 was calculated with the BLASTO (Reed, 1988) code.

Finally, atmospheric effects can increase the blast overpressure in the far field. The worst case effect is that of atmospheric focusing. Due to changes in sound speed with temperature, variations in temperature with altitude can result in caustics (focused shock waves) (Reed, 1987, 1988).



Overpressure vs. Distance

Note: Detonation of 12,700 kg of hydrogen in air. Cloud is axisymmetric with a 100 m radius and a 20 m height and is a mixture of stoichiometric hydrogen/air. The ambient temperature is 278 K and the ambient pressure is 84.5 kPa. The overpressure is the incident or "side-on" overpressure. The allowable overpressure levels for public traffic and inhabited buildings are based on DOD standard 6055.9 requirements.

Figure E-2

Caustics can cause a three- to five-fold increase in the expected pressure. For this analysis, the caustic effects are also calculated with the BLASTO (Reed, 1988) code.

5.4 CONSEQUENCES

Figure E-2 shows the overpressure levels corresponding with different levels of damage. The 1 percent mortality and 1 percent ear drum rupture levels are taken from DOD 6055.9-STD (Assistant Secretary of Defense, 1991) and are 186 kPa (50 millisecond duration) and 23.4 kPa, respectively. The 1 percent window breakage is taken from Reed (1987) and is 0.9 kPa. Also shown in Figure E-2 are the allowable levels for public traffic routes and inhabited buildings. These values are taken from DOD 6055.9-STD (Assistant Secretary of Defense, 1991) and are 11.7 kPa and 6.2 kPa, respectively.

Table E-29 gives the distances to the various threshold levels for the single dewar accident. Using the standard one-third power scaling law, the distances for the detonation of all hydrogen on station is 3.4 times the values listed in Table E-29.

Table E-29. Damage Distances from Single Dewar Accident

Threshold	Distance (kilometers)
1% Window Breakage	19.5
Safe Inhabited Building Distance	1.5
Safe Public Road Distance	0.825
1% Ear Drum Rupture	0.525
1% Death	0.2

In summary, for the single dewar accident, the on-station consequences for both SMTS and CTF include injury and death for all unprotected personnel and structural damage to the facility. On-site but off-station consequences for all three potential stations include possible minor structural damage (window breakage). For the SMTS, there are no off-site consequences as the nearest public boundary is 23 kilometers, beyond the 19.5 kilometers predicted damage distance. For the CTF, some window breakage is possible off site due to the shorter public boundary distance (13 kilometers).

6.0 ANALYSIS OF ACCIDENT-CASE BERYLLIUM RELEASE

The PIPET and GTA assemblies contain beryllium metal which may become airborne in a catastrophic failure. In the event of an accident in which core integrity is lost (see Section 2.4), there is the potential for some or all of this

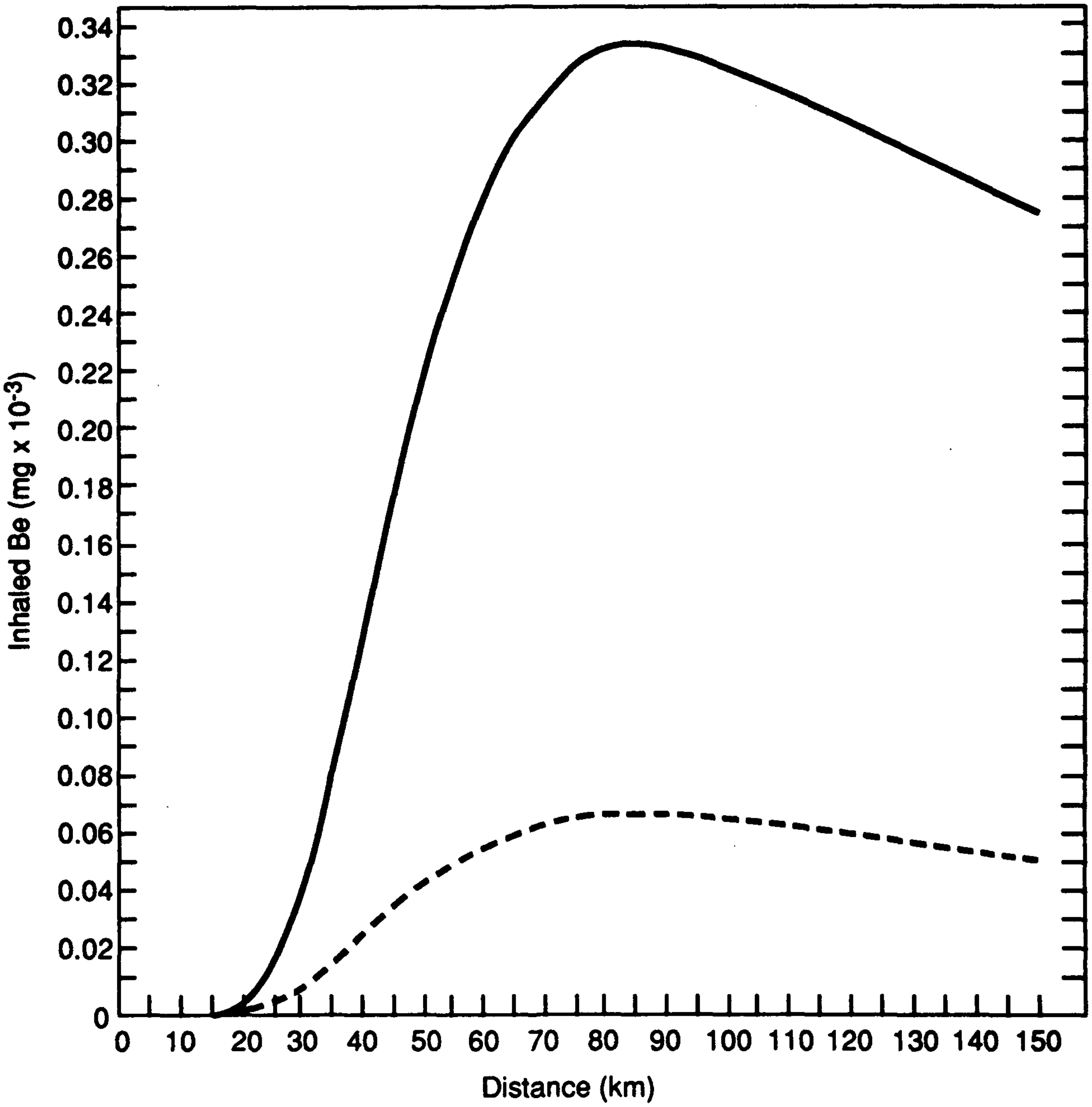
beryllium to be released. Since oxidized respirable beryllium is considered a toxic material, its impact on the public must be considered. At this time there is no credible accident case which can be identified in which significant amounts of beryllium can be mobilized; however, in order to determine a conservative evaluation of potential impacts, an analysis using complete beryllium dispersal was performed.

The release data for determining beryllium inhalation was taken from SNL engineering estimates. The estimate of beryllium available for release is approximately 44 pounds for PIPET and 220 for the GTA test systems. These amounts were assumed to be fully aerosolized in a maximum-case accident and subsequently dispersed into the resulting plume.

The aerosolized beryllium dispersion was modeled using the MACCS plume release model. The MACCS code provides information concerning the total amount of airborne particulates to which a person may be exposed (time-integrated ground-level air concentration data) at any distance downwind of the release point. The amount of beryllium inhaled is determined by multiplying the time-integrated ground-level beryllium air concentration by the typical human breathing rate (3.47×10^{-4} cubic meters per second). The peak concentration of the beryllium cloud at the point of maximum inhalation is shown in Figure E-3 as well as concentrations at all locations directly downwind (referred to as the "centerline").

Additional beryllium may be located in the axial core reflectors; however, analysis of the proposed core designs indicates that this material is sufficiently removed from any potential heat sources and that release as an aerosol is not possible. This material may be distributed in large fragments within the immediate vicinity of the accident site, but would not constitute an inhalation hazard.

OSHA has developed standards for the occupational exposure of workers to beryllium. These are determined using toxicological and past exposure history data to arrive at total exposure (amount of beryllium inhaled) to which an occupationally exposed person may be exposed on a daily basis without suffering any harmful effects. The allowable exposure incorporates safety factors to account for sensitive individuals, as well as adequate safety margins, and therefore does not represent an absolute threshold value above which effects will be observed. Rather, it can be expected that for most individuals, it would require a considerably higher single-day exposure to produce any noticeable effect. The maximum daily exposure to beryllium which has been established by OSHA is 0.0173 milligrams. Using this as a starting point, a value for allowable airborne concentrations is calculated (again using the above breathing rate of 3.47×10^{-4} cubic meters per second) based upon an exposure time of 8 hours per day (a typical work day). This calculated value, which is expressed in milligrams of beryllium per cubic meter of breathing air (mg/m^3), is referred to as the Permissible



EXPLANATION

GTA Release

PIPET Release

Beryllium Inhalation as a Function of Distance

Figure E-3

Exposure Limit (PEL), and has a value of 0.002 mg/m^3. Since exposure to beryllium may also induce immediate harmful effects in cases of extremely high concentrations, OSHA has also adopted a value of 0.025 mg/m^3 as the highest allowable airborne concentration to which a worker may ever be exposed, without consideration of exposure time or total dose received.

A GTA release, which is the maximum-case beryllium release, would result in a maximum total exposure (through inhalation) of approximately 0.00033 mg, which is over 50 times lower than 0.0173 mg value adopted by OSHA for total daily exposure. Furthermore, a maximum airborne concentration of 0.016 mg/m^3 is calculated for a GTA accident release, which is almost a factor of two lower than the OSHA peak concentration limit of 0.025 mg/m^3. Beryllium exposures from the postulated PIPET accident would be approximately 20 percent of GTA values (see Figure E-3).

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APPENDIX F

SITE NARROWING REPORT SUMMARY

APPENDIX F
SITE NARROWING REPORT

Summary

The site narrowing report documents the process, rationale, and results of the siting methodology used to narrow the location of the Test Program from multiple sites throughout the Continental United States (CONUS) to three sites.

A systematic, multidisciplinary approach was implemented to incorporate all technical, operational, policy, and legal factors into the siting process and to achieve four basic goals: (1) maximize project effectiveness by maximizing project security, optimizing site operations, and maximizing mission compatibility; (2) minimize cost through maximizing constructability and minimizing construction requirements; (3) minimize public impacts by minimizing economic impacts and maximizing public safety, and (4) minimize environmental impacts through minimizing impacts to the natural and cultural resources and to special status lands.

The site selection process established to achieve these goals was based on the application of exclusionary and evaluative criteria. Exclusionary criteria define the minimum level of acceptability of alternative sites. Evaluation criteria did not exclude sites, but were developed to measure preferences for specific site characteristics. All of these criteria are presented in the Final Site Narrowing Report (THG, 1991).

Exclusionary Criteria

Initial screening began with the application of the exclusionary criteria which required that the site be a federally owned facility and be located within the CONUS. In addition, sites were screened for similarity of operations. Specifically, sites were excluded if they did not currently host similar nuclear research operations and have the infrastructure to support defense-related nuclear research activities. It was at this point that several Department of Defense (DOD) sites were dropped from the list, leaving thirteen Department of Energy (DOE) sites for further consideration.

The second step in the narrowing process involved the application of the "stand-off" requirement that required that the site be at least 15 km (9.3 miles) from the nearest urban area as measured on a U.S. Geologic Survey (USGS) 1:100,000 scale map. This eliminated all but the four sites of Hanford, Idaho National Engineering Laboratory (INEL), Nevada Test Site (NTS), and the Savannah River Site (SRS).

DOE determined that the proposed test program created a significant conflict with the Hanford and Savannah River operations (THG, 1991). Savannah River is currently the primary source for tritium production in the United States. Siting the test facility at Savannah River would conflict with wetlands and special status lands on the installation as well as the use of public roads that cross SRS. Hanford was excluded because it is currently undergoing environmental restoration as a requirement of a memorandum of agreement with the State of Washington. The ground testing program is not compatible with this agreement or the restoration activities. Also, the public

attention that Hanford has received recently regarding the environmental restoration program is inconsistent with the program security requirements.

Following the application of the exclusionary criteria and the discussions with DOE regarding Hanford and Savannah River conflict issues, the process of applying the evaluative criteria to the two remaining installations, NTS and INEL, began.

Evaluative Criteria

A team consisting of government and contractor experts in safety, security, program technology, and civil and environmental engineering was formed to apply the evaluative criteria to identify specific alternative sites at NTS and INEL. This team met with installation representatives who were familiar with operations, land use, and other concerns at the installations. Discussions with these representatives placed particular emphasis on ongoing and planned land use in the immediate area of any potential alternative site which might be considered.

Based on the requirements of the program and the knowledge of the installation representatives, three specific sites were identified for further evaluation. These included the Saddle Mountain Test Station (SMTS) at NTS and the QUEST and LOFT sites at INEL. Tours of the installations were conducted and specific site visits were made to SMTS and LOFT. Sufficient characterization of the QUEST site was possible with a reconnaissance of the areas surrounding the site and published information.

The SMTS was considered the preferred site due primarily to its remoteness and seclusion. The ultimate site selection decision will be based on the siting report, the EIS, and other program documents.

APPENDIX G

CULTURAL RESOURCES

ARCHAEOLOGICAL AND HISTORIC SURVEY REPORT
IDAHO ARCHAEOLOGICAL SURVEY

A. Project Name and Statement of Objectives

Project Name: Cultural Resources Investigation - Idaho National Engineering Laboratories (INEL) - Containment Test Facility Site (CTF) (also known as Loss-of-Fluid Test Site [LOFT]) and QUEST Site

Objective: To evaluate the significance of cultural resources within the area of potential effect (APE) for both alternatives at the INEL, assess direct and indirect impacts to any identified resources, and recommend appropriate mitigation measures to be incorporated into the Environmental Impact Statement

B. Name and Full Description of the Proposed Undertaking

Name: Space Nuclear Thermal Propulsion Program - Environmental Impact Statement

Description of the Proposed Undertaking: The Department of the Air Force and the Department of Energy propose to validate the technology of a particle bed reactor propulsion system. Validation of this technology may open doors in the areas of space travel, power generation, and disposal of nuclear waste. Two locations at the Idaho National Engineering Laboratory, the CTF and the Quest sites, were selected early in the site narrowing process as reasonable alternatives for ground test activities (Figures 1, 2, 3, and 4). Since that time, the QUEST site has been eliminated from consideration as an alternative, because of the presence of significant cultural resources identified during the environmental process. Because cultural resources field work has already been initiated for the QUEST site, this survey report will include that data, even though the site is no longer considered an alternative for the SNTP program.

Selection of the CTF alternative would require modification of existing facilities and the construction of a hydrogen tank farm. Selection of the QUEST alternative would have required construction of all facilities, roads, and infrastructure. Direct impacts from SNTP program activities would include those associated with above and below ground construction and from facility remodeling.

Indirect impacts could result from increased personnel and vehicular use of sensitive areas, erosion, and the potential for unauthorized artifact collection and vandalism.

C. Location and General Environmental Setting

INEL lies within the Snake River Plain of southern Idaho adjacent to the foothills of the Lemhi, Lost River, and Bitterroot Mountain ranges. Archaeological and paleontological investigations of the Snake River Plain have identified several sites significant in North American prehistory, including Wilson Butte Cave (southwest of the INEL), the Wasden Site/Owl Cave (just east of the INEL), and the Birch Creek Sites/Bison and Veratic Rockshelters (north of the INEL). Intensive survey and test excavation within the INEL boundaries has also contributed to a greater understanding of this region, which spans a period of time that covers 12,000-15,000 years. To date, over 1000 sites have been recorded on the INEL with only three percent of the total 890 square miles of the installation surveyed.

Paleontological resources have been identified throughout the INEL, as well. Sites appear in lava tubes, rockshelters, caves, packrat middens, and alluvium, and reflect the remains of extinct animals such as the camel, mammoth, and North American horse.

<u>CTF Alternative</u>
The CTF site at INEL is located in a portion of Test Area North (TAN) located in the northern part of the installation, near the western margin of the Birch Creek playa (see Figures 1 and 2). Existing facilities, paved roads, and infrastructure to support the SNTP program are already located at this location and the entire facility area has been previously disturbed through grading and construction, including raising the surface of the site with fill pads by about 15 feet.

U.S.G.S. Topographic Map: Circular Butte, Idaho
Boundary of Sections 11 and 12 - Township 6 North, Range 31 East

<u>QUEST Alternative</u>
The QUEST site at INEL is located in the east central portion of the installation (see Figures 1, 3, and 4). It is located in an undeveloped area that contains a ridge which rises approximately 50-100 feet above adjacent plains and marks the forward margin of a single

basalt flow; surficial soils are present in varying depths. The site is accessed only from the north and south along a narrow, rutted, and rocky road that was built to access an overhead transmission line. All of the facilities and infrastructure would have to be constructed for the SNTP program at this site (approximately 200 acres) and the main access road would have to be improved.

U.S.G.S. Topographic Map: Little Butte NW, Idaho
Sections 11, 12, 13, 15 - Township 4 North, Range 32 East

D. Pre-Field Research

1. Sources of information checked:
   [X] Overviews
   [X] Site Sensitivity Maps at EG&G Idaho, Inc.
   [X] Other

EG&G Idaho, Inc., no date. LOFT (Loss of Fluid Test), Idaho Operation Office.

Idaho National Engineering Laboratory, 1986a. Idaho National Engineering Laboratory, *History of Facilities and Programs.*

Idaho National Engineering Laboratory, 1986b. Idaho National Engineering Laboratory Annual Report.

Idaho State University, 1986. Archaeological Investigations on the Idaho National Engineering Laboratory 1984-1985, August.

Idaho State University, 1987. Archaeological and Paleontological Survey of the INEL for the SSC NEPA Compliance Plan, December.

Smithsonian Institution, 1986. Handbook of North American Indians, Washington D.C., Volume 11, Great Basin.

U.S. Department of Energy, Idaho Operations Office, no date. The OECD LOFT Project.

U.S. Department of the Interior, National Park Service, 1991. National Register Bulletin 15.

Walker, D. E., 1978. Indians of Idaho, University of Idaho Press, Moscow, Idaho.

2. Summary of previous studies in this general area:

CTF Area of Potential Effect
Several areas associated with the TAN facility, which includes the CTF, were examined between 1982 and 1985 as a part of a program designed to identify cultural resources in danger of being disturbed through increased installation activities on the INEL (Idaho State University, 1986). In July 1985, an archaeological/paleontological survey of a 100-meter-wide zone (328 feet) surrounding the CTF facility was conducted by EG&G; one sparse lithic scatter (10-BT-1234) and one isolated activity area (10-BT-1235) were recorded during this survey; neither was considered of sufficient significance to be potentially eligible for the National Register (Idaho State University, 1986). While fossil camel remains have been identified in the vicinity of the TAN facility, no paleontological resources have been recorded or identified in the CTF site area.

Quest Area of Potential Effect
Reconnaissance-level survey was accomplished in 1992 by EG&G archaeologists at the primary site of construction for SNTP Program activities and intensive surveys were completed in 1985 by EG&G for a grazing boundary and along the road which accesses QUEST site from the Argonne National Laboratory-West (ANL-W) to the south (Idaho State University, 1986). Site types include hunting locations, field camps where game processing occurred, and tool modification areas; some of these sites are potentially eligible for the National Register. No paleontological remains have been confirmed within the APE for the QUEST site. However, an extensive packrat midden, similar to those which typically have the potential to yield such resources, is located within the talus of the lava flow.

E. Expected Historic and Prehistoric Land Use and Site Sensitivity

CTF Alternative
1. Are there sites known in this area? [X] Yes [ ] No
2. Are sites expected? [ ] Yes [X] No

Previous surveys of the area surrounding the TAN/CTF facilities indicate a low probability for encountering additional cultural

resources (Idaho State University 1986). Consultation with INEL's cultural resources contractor, EG&G, confirmed that no further archaeological surveys would be required for SNTP Program activities at the CTF site.

<u>QUEST Alternative</u>
1. Are there sites known in this area? [X] Yes [ ] No
2. Are sites expected? [X] Yes [ ] No

Previous intensive archaeological survey and reconnaissance performed by EG &G archaeologists indicates a high degree of archaeological sensitivity in the QUEST ridge area (see Figure 3). The current level of survey has recorded over 50 sites within this region representing a density of approximately four sites per linear mile and indicating the highest site density encountered to date on the INEL (Idaho State University, 1986). Some of the sites located along the access road between ANL-W and the QUEST site are believed to be potentially eligible to the National Register.

F. Field Methods

1. Areas examined and type of coverage:

<u>CTF Alternative</u> (see Figure 2)
Intensive survey by EG&G in 1985

<u>QUEST Alternative</u> (see Figure 3)
Reconnaissance by EG&G in 1985 and 1992
Reconnaissance by The Earth Technology Corporation, accompanied by EG&G, in 1992

2. Surface and subsurface visibility:

<u>CTF Alternative</u>
The CTF APE is partially covered by existing facilities, paved roads, and parking lots (30 percent); vegetative cover in open spaces is sparse to non-existent.

<u>QUEST Alternative</u>
Because the QUEST site is partially located within a lava flow, much of the surface is basalt covered (60 percent); plains adjacent to the flow are covered by moderate to sparse vegetation (40 percent).

3. Acres Surveyed

<u>QUEST Alternative</u>

Reconnaissance: Approximately 400 acres in early 1992 (EG&G)
Approximately 200 acres in April 1992 (TETC accompanied by EG&G)

4. Areas not examined and reasons why:

CTF site - surveyed in 1985 - (see Figure 2)

Access road from Argonne Lab past the Quest site and ending near the southern boundary of Section 26 - surveyed in 1985 - (see Figures 3 and 4)

5. Personnel conducting or assisting in the survey:

<u>The Earth Technology Corporation</u>

Paige Peyton, Field Director
Senior Project Environmental Specialist in Cultural Resources

Paul Titus
Project Environmental Specialist in Cultural Resources

Peter Xander
Senior Project Environmental Specialist in Biological Resources

Brian Mayerle
Staff Ecologist

<u>EG&G</u>

Clayton Marler, Archaeologist
Brenda Ringe, Archaeologist
Tim Reynolds, Biologist

6. Dates of Survey:

April 14-15, 1992

7. Problems Encountered:

See "G." below.

G. Results

1. Cultural resources noted but not formally recorded

Survey of the QUEST site APE was performed by Air Force contractor archaeologists (Earth Technology) in April 1992, accompanied by EG&G archaeologists familiar with the region. Because of the topography and the extent and complexity of the primary site (previously identified and recorded as EGG-92-2-1), traditional survey techniques (systematic transects and mapping) were abandoned and organized reconnaissance was employed. Site edges could not be accurately determined and are felt to extend well beyond the APE for SNTP Program construction activities in all directions, particularly north and south along the ridge line. Diagnostic projectile points were scant, but those that were present indicate a period of occupation that covers approximately 7500 years. Because of the depth of surficial soils noted throughout the APE and the high winds common to the area, the potential for buried resources exists and the currently estimated time frame for occupation may increase. The site is an extensive scattering of lithic and ceramic materials with features that include hearths and associated fire-cracked rock; pottery sherds; burned bone/tooth enamel fragments associated with lithic materials; an extensive packrat midden; and chinked stone walls of undetermined purpose which are unique on the INEL. In addition to ignimbrite, at least ten exotic source materials were identified (e.g., obsidian, assorted colors of cryptocrystallines, fine-grained basalts, and rhyolite). No rock art, rock shelters, lava tubes, or confirmed evidence of pleistocene megafauna were noted. Except for the area immediately surrounding the QUEST benchmark and disturbance caused by traffic along the power line access road, the entire QUEST site APE remains undisturbed. No cultural materials were collected during the survey.

H. Conclusions and Recommendations

<u>CTF Alternative</u>

Two prehistoric archaeological sites (one sparse lithic scatter [10-BT-1234] and one isolated activity area [10-BT-1235] have the potential to be effected by SNTP Program activities at the CTF site. Neither of these sites are considered significant under National Register criteria and all of the previous surveys of the area surrounding the TAN facility (which includes CTF) indicate a low probability for encountering additional cultural resources (Idaho State University 1986). Consultation with INEL's cultural resources

contractor, EG&G, confirmed that no further archaeological surveys would be required for SNTP Program activities at the CTF site. Because of these findings, no adverse impacts are expected to occur to archaeological resources if the CTF alternative is chosen for SNTP activities.

Recommended Mitigation

Although the known archaeological resources located within the CTF APE are not considered significant and the probability for additional sites is low, the presence of sites does indicate some potential for cultural resources to be discovered during the course of project activities. In the event that archaeological, paleontological, or Native American resources are discovered, ground disturbing activities would immediately cease and a qualified archaeologist would be notified; all subsequent actions would comply with 36 CFR 800.11 and the Native American Graves Protection and Repatriation Act (NAGPRA).

QUEST Alternative

Archaeological site EGG-92-2-1 is an extensive lithic and ceramic scatter that is unique to the INEL because of its size, complexity, and long history of occupation. Because of the amount, richness, and diversity of its cultural materials, it has the potential to contribute significantly to the current understanding of North American and Idaho prehistory and may therefore be potentially eligible to the National Register under criterion D. Archaeologists familiar with the area indicate that it is unique, as well, because of chinked basalt structures found along the lava ridge that do not appear elsewhere on the INEL. Although the density in the distribution of cultural material at this site fluctuates from area to area, the entire APE for this program (including the access road) contains cultural material, thereby making avoidance virtually impossible. Because of these findings, extensive direct and indirect impacts would occur to cultural resources if the QUEST alternative is chosen for SNTP activities.

Archaeological and paleontological sites are finite, nonrenewable resources, whose salient characteristics are easily diminished by physical disturbances. Because of this, avoidance and preservation in place is the preferred treatment. In consideration of the above described cultural resources complexion at the QUEST site, the Air Force has recognized the significance of the identified resources and has removed the QUEST site from consideration as an alternative for SNTP program activities.

If, however, the QUEST alternative is reconsidered for future program activities, the following mitigation measures are recommended:

If avoidance is not possible or practicable, implementation of the following mitigation measures, in consultation with the Idaho SHPO and the Advisory Council on Historic Preservation, can reduce adverse effects at the QUEST site to a non-adverse level; consultation would continue until such time that all requirements under Section 106 have been satisfied.

Prior to any ground disturbing activities:

- Evaluation of archaeological site EGG-92-2-1 to determine its eligibility to the National Register

- The access road from ANL-W to the QUEST site requires improvement. Previous surveys along this road have recorded numerous sites and indicate that some may be eligible to the National Register; these sites would also require evaluation

- Development and implementation of a research design and data recovery plan based on the Secretary of the Interior's Standards and Guidelines: Archaeology and Historic Preservation

- Implementation of the research design would be under the direction of a qualified archaeologist, as described in 36 CFR 61, Appendix A(b) and would include but not be limited to:

    - Detailed mapping/photography

    - Archaeological/paleontological subsurface testing or non-destructive testing as appropriate

    - Curation of recovered artifacts in accordance with 36 CFR 79

- Archaeological monitoring during all ground disturbing activities

- Other mitigation measures developed during the consultation process.

I. Attachments

Four Figures

J. Respository

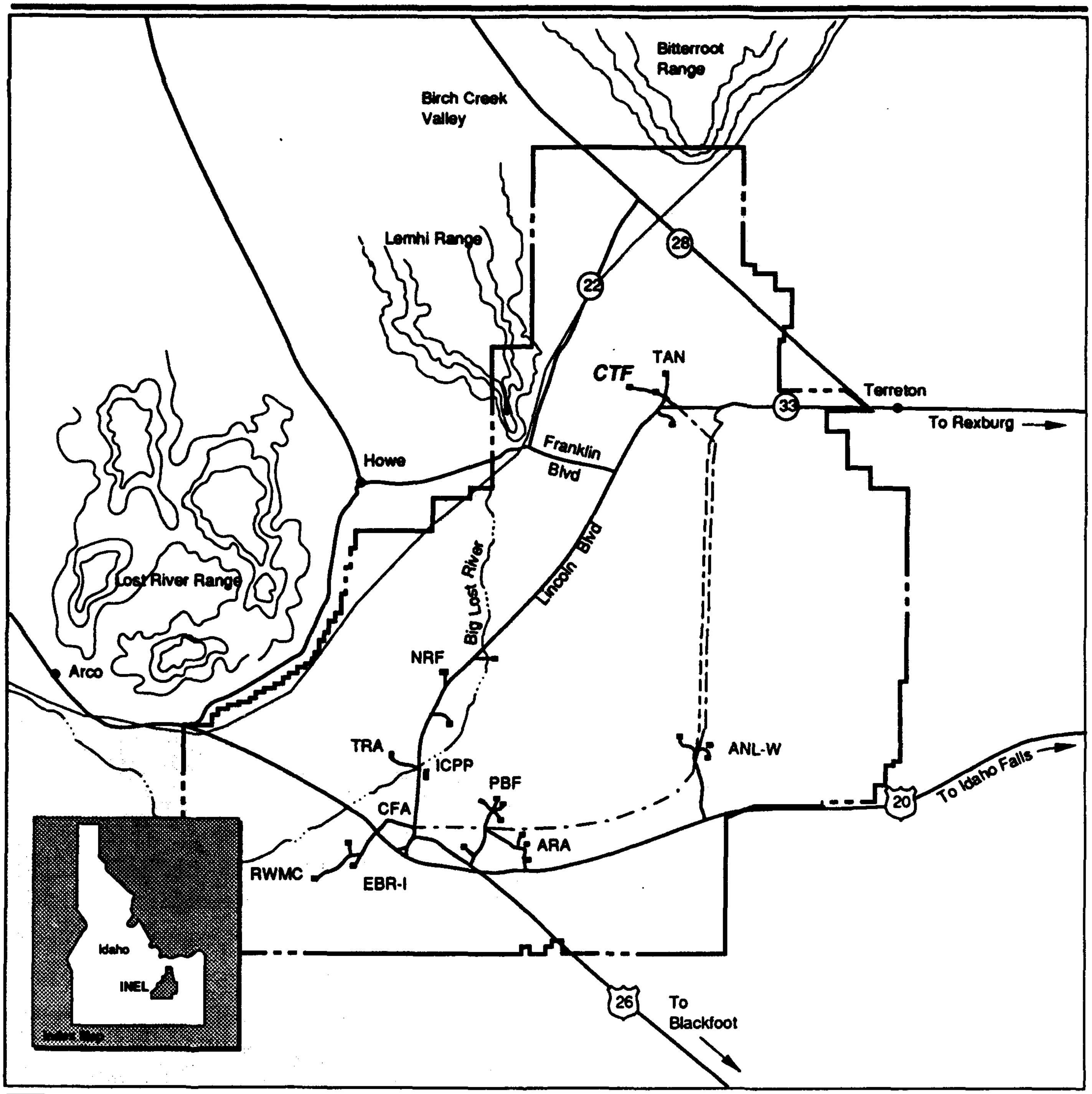
The Earth Technology Corporation
1461 East Cooley Drive
Suite 100
Colton, California 92324

K. Certification of Results

I certify that I conducted the investigation reported here, that my observations and methods are fully documented, and that this report is complete and accurate to the best of my knowledge.

Paige M. Peyton
Paige M. Peyton, Field Director

June 2, 1992
Date



EXPLANATION

Transmission Line

Dirt Road

Snake River Plain

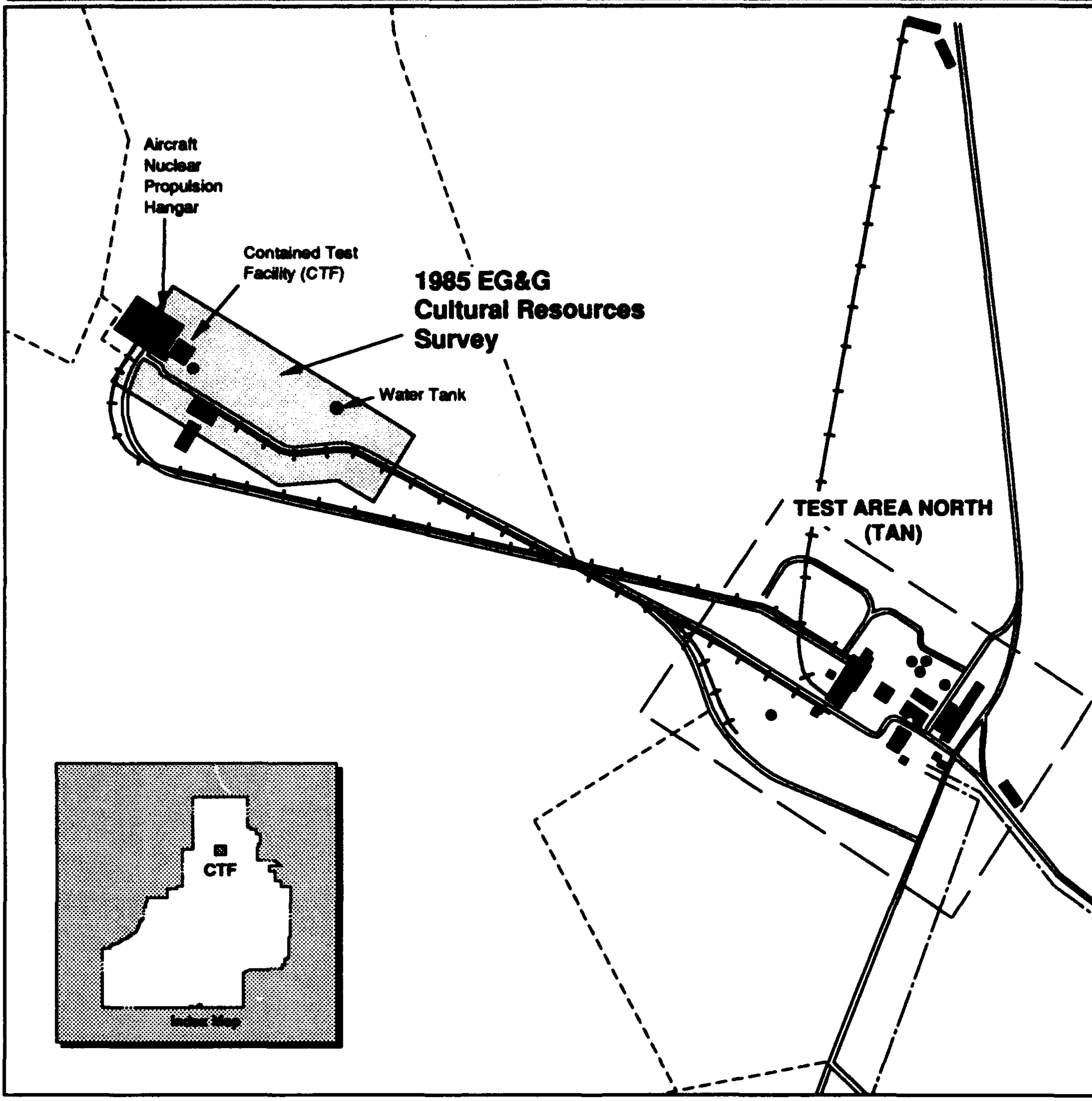
0 2 4 8 Miles

Idaho National Engineering Laboratory

CTF Site

Figure 1

PHL/038-2

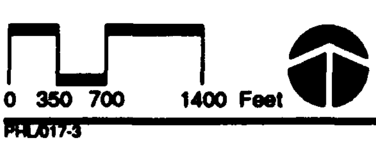


EXPLANATION

- - - - - - Dirt Roads

——·—— Transmission Lines

1985 EG&G Survey

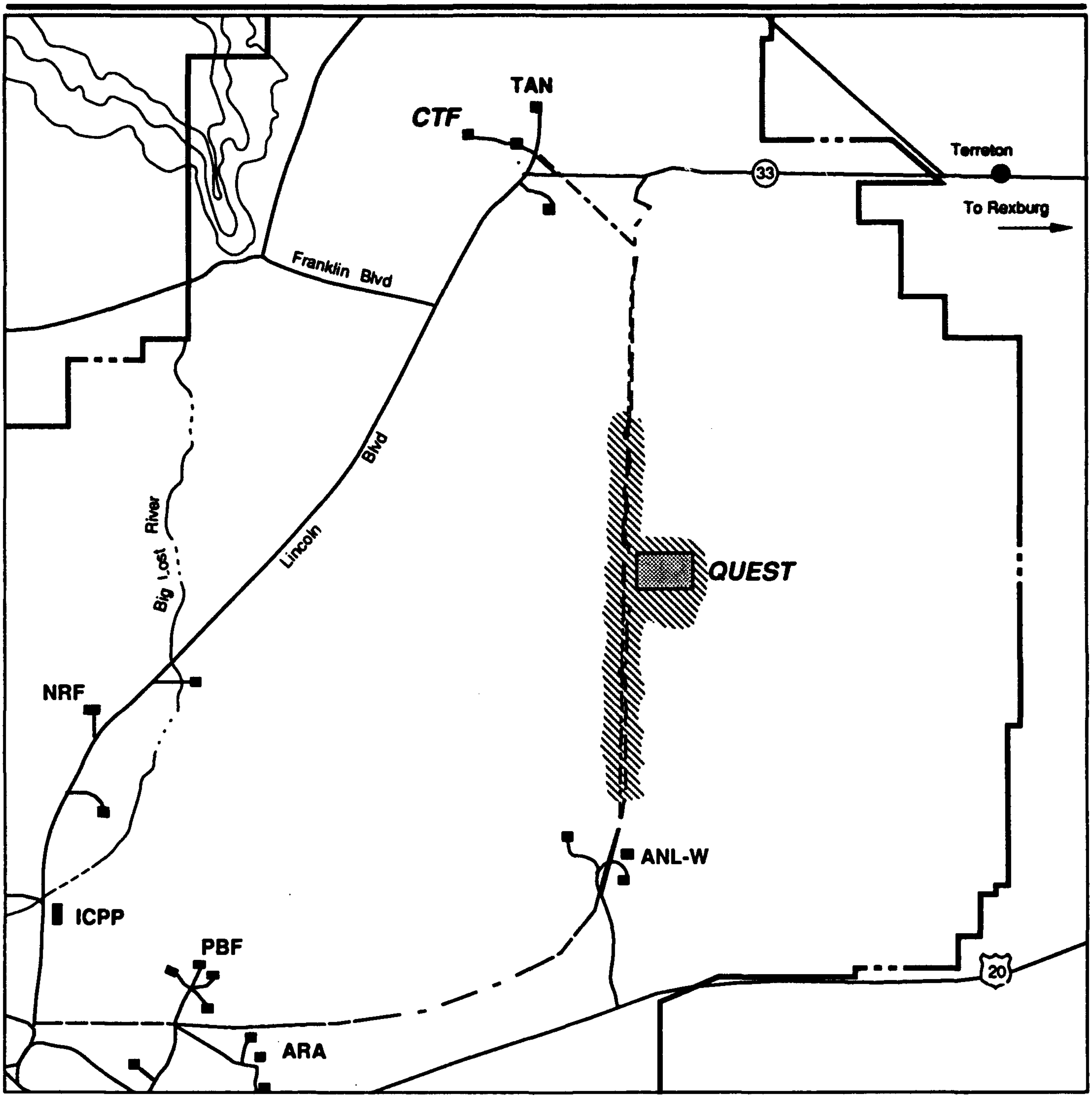


PHJ017-3

Idaho National Engineering Laboratory

CTF Site Cultural Resources Survey

Figure 2



EXPLANATION

Cultural Recources Sensitivity Area

Transmission Line

Dirt Road

INEL Boundary

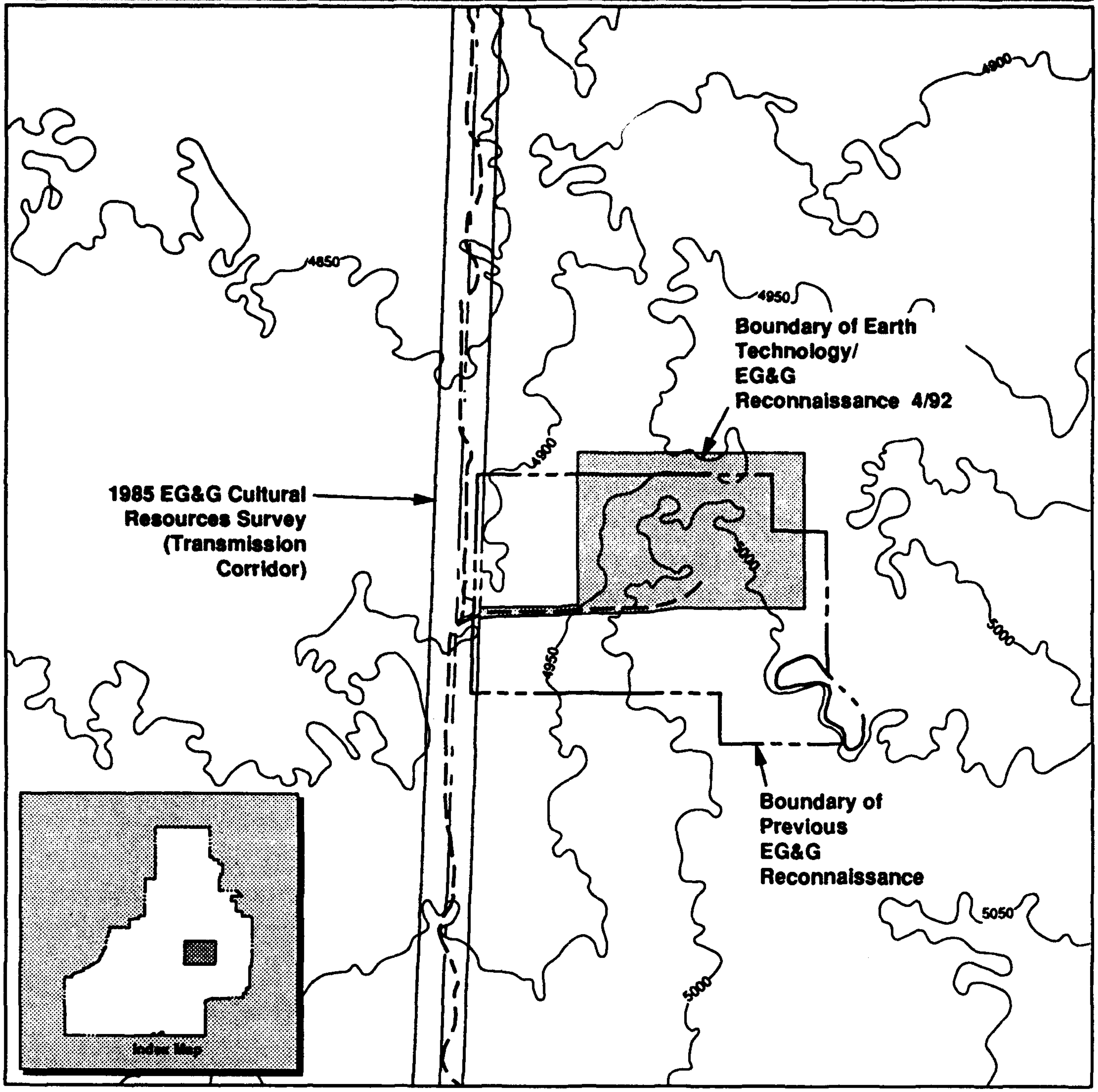
0 1 2 4 Miles

Idaho National Engineering Laboratory

QUEST Site Cultural Resources Sensitivity

Figure 3

PHL/036-1



EXPLANATION

— · — Transmission Line

- - - - - Dirt Road

Boundary of Earth Technology/EG&G Reconnaissance 4/92

Boundary of Previous EG&G Reconnaissance

0 500 1000 2000 Feet

Idaho National Engineering Laboratory

QUEST Site Cultural Resources

Figure 4

PHL/039-2

IDAHO STATE HISTORICAL SOCIETY

CECIL D. ANDRUS, Governor

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CLAYTON E. MARLER
NOV 1 8 1991

Control =
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November 15, 1991

Clayton Marler
E G & G Idaho, Inc.
P.O. Box 1625
Idaho Falls, Idaho 83415

Dear Clayton:

I am sorry it has taken so long to write and thank you, EG&G and the Department of Energy for the tour of the D & D facilities last August. Tom Thiel (EG&G), Andy Mikkoia (DOE), and Roger Twitchell (DOE) were especially helpful in explaining the project.

As you know, we believe the various reactors and associated buildings, such as those at the ARA I, II, III, the Borax Reactor, MTR, ETR and the Hot Shop, are eligible for the National Register of Historic Places. We realize these facilities are not fifty years old, but they are of exceptional scientific and engineering significance, and all have played major roles in the development of nuclear science since World War II. Hence, the removal of these structures is an adverse effect under section 106 of the National Historic Preservation Act (NHPA) and DOE must consult with the Advisory Council.

We do recognize these are not normal facilities that can be preserved for the public like the EBR-1 reactor and the nuclear aircraft engines. Consequently these facilities need to be documented following the standards of the Historic American Engineering Record. This is a great opportunity (and requirement of the National Historic Preservation Act) to create a history, not only of these reactors, but of the whole INEL site.

Celebrate IDAHO

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In order to comply with section 106 of the NHPA, DOE needs to consult with Advisory Council's Western Field Office in Denver (Claudia Nissley - (303) 231-5320. A programmatic agreement needs to be written that will outline the various mitigative requirements. We will be happy to help prepare such an agreement.

Sincerely,

Thomas J. Green

Thomas J. Green
Deputy State Historic
Preservation Officer

TJG:dac

[illegible]
Governor

STATE OF NEVADA

[illegible]
Director

[illegible]
State Historic Preservation Officer

RSH

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF HISTORIC PRESERVATION AND ARCHEOLOGY
123 W. Nye Lane, Room 208
Capitol Complex
Carson City, Nevada 89710
(702) 687-5138

June 19, 1992

Dr. Donald R. Elle
Environmental Protection Division
Nevada Operations Office
Department of Energy
P.O. Box 98518
Las Vegas, NV 89193-8518

Dear Dr. Elle:

The Division of Historic Preservation and Archeology received the following DOE cultural resources report for review:

> A Class III Cultural Resources Reconnaissance of the Proposed Saddle Mountain Project, Area 14, Nevada Test Site, Nye County, Nevada (NTS-923414).

Intensive archaeological survey failed to reveal any historic properties within the area of potential effect. As no historic properties were found, the DOE has completed its Section 106 consultation with this office for the proposed Saddle Mountain Project, unless archaeological materials are encountered during construction.

Sincerely,

Eugene M. Hattori

Eugene M. Hattori
Archaeologist

ACTION ERO
INFO
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MA
AMESH
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June 8, 1992

Ms. Paige Payton
Senior Project Environmental Specialist
Cultural Resources Management
The Earth Technology Corporation
275 West Hospitality Lane
Suite 220
San Bernardino, California 92408

RE: Space Nuclear Technology Program

Thank you for notifying our office that the Department of the Air Force has identified the QUEST Site and the LOFT Site on the Idaho National Engineering Laboratory as potential locations for the Space Nuclear Thermal Propulsion (SNTP) Program ground test station. After reviewing our records, we have the following comments:

1.) QUEST Site (T4N, R32E, Sec.11,12,13,14): Consultation with EG&G Cultural Resource Management (CRM) staff indicates that a large archaeological site has been identified within the SNTP project boundaries at the QUEST Site. Because construction of the facility would adversely effect the site, the Advisory Council on Historic Preservation will have to be consulted.

2.) LOFT Site (T6N, R31E, Sec.11,14): Construction of the ground test station at the LOFT Site would require modifications to the existing LOFT facilities. Since the facility is eligible for the National Register, archival research and documentation of the existing structures need to be completed prior to alteration. As well, an archaeological assessment of the project area should be conducted.

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Ms. Paige Payton
June 8, 1992
page 2

Once we receive more detailed information on the proposed construction, we will consult with EG&G CRM staff and your office on specific recommendations. If you have any questions, feel free to contact either myself or Suzi Neitzel at 208-334-3847.

Sincerely,

Susan P. Neitzel

Thomas J. Green for
Deputy State Historic
Preservation Officer

TJG/spn
cc: Brenda Ringe, EG&G Idaho
Clayton Marler, EG&G Idaho

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August 13, 1992

Ms. Teresa Perkins
U.S. Department of Energy
785 DOE Place
Idaho Falls, Idaho 83402

RE: Space Nuclear Thermal Propulsion Program
CTF (LOFT) Facility, INEL, Idaho

Dear Ms. Perkins:

Thank you for providing myself and Suzi Neitzel an opportunity to tour the CTF, or LOFT, facility on the Idaho National Engineering Laboratory (INEL), Idaho Falls, Idaho. We fully support the Department of Energy's (DOE) proposed adaptive use of the LOFT through the establishment of the Space Nuclear Thermal Propulsion (SNTP) program.

As stated in our letter of 8 June 1992, we feel the LOFT facility is eligible for the National Register of Historic Places because of its exceptional national and regional significance in the history of nuclear development and scientific research. Although we feel that proposed alterations to LOFT for the SNTP program will have an adverse effect on the structure, we do not object to the continued use of the building. To mitigate the effects, we recommend that DOE complete photographic and historical documentation of the facility according to the standards of the Historic American Engineering Record. Additionally, DOE should incorporate information from oral histories into the historical narrative.

Following Section 106 of the National Historic Preservation Act and 36 CFR Part 800, DOE needs to notify the Advisory Council on Historic Preservation of project effects on the facility (36 CFR Part 800.5e).

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We look forward to working with EG&G's cultural resource staff to develop a Memorandum of Agreement stipulating the mitigation requirements. If you have any questions, feel free to contact either myself or Suzi Neitzel at 208-334-3847.

Sincerely,

Kenneth J. Swanson
State Historic
Preservation Officer

KJS/spn

cc: Clayton Marler, EG&G Idaho
Susanne Miller, EG&G Idaho
Brenda Ringe, EG&G Idhao

Department of Energy
Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

August 25, 1992

Ms. Claudia Nissley, Director
Western Office
Advisory Council on Historic Preservation
730 Simms Street, Room 401
Golden, Colorado 80401

SUBJECT: Request for Section 106 Consultation (AM/SES-ESD-92-342)

Dear Ms. Nissley:

The Department of Energy, Idaho Field Office (DOE-ID) is considering plans to modify a facility located on the Idaho National Engineering Laboratory (INEL). The modification(s) would take place at the Loss of Fluid Test Facility (LOFT), also known as the "Contained Test Facility". The purpose of modifying LOFT would be to accommodate future programs.

In consultation with the Idaho State Historic Preservation Office (SHPO), we have determined that LOFT is eligible for inclusion in the National Register. Additionally, SHPO indicated that the planned modification would have an adverse effect based upon application of the criteria of effect and adverse effect at 36 CFR Part 800.9.

In accordance with Section 106 of the National Historic Preservation Act and 36 CFR Part 800.5(e), we request that the Advisory Council participate in consultation with SHPO and DOE-ID concerning LOFT. This consultation process is intended to result in a Memorandum of Agreement (MOA) between DOE-ID, SHPO, and the Advisory Council. The MOA would outline means of minimizing impacts to the historic significance of LOFT while accommodating its future use for scientific research compatible with the original design and intent of the facility.

The enclosed documentation describes:

- LOFT and experimental programs that have taken place there;
- efforts, to date, to document LOFT's historic significance;
- possible modifications of LOFT;
- effect of modification on historic integrity;
- proposed actions to preserve LOFT's historic context and guide changes to the facility;

- draft tri-party Memorandum of Agreement (MOA).

We look forward to your comments and response to this consultation request. If you have any questions, and for further coordination concerning this matter, please contact me at (208) 526-1483.

Sincerely,

Teresa L. Perkins

Teresa L. Perkins
DOE-ID NEPA Compliance Officer

Enclosure

cc: S. Neitzel, SHPO, w/enc.
C. F. Marler, EG&G, CRM, w/o enc.

Version 9/20/92

DRAFT

MEMORANDUM OF AGREEMENT

Whereas, the U.S. Department of Energy, Idaho Field Office (DOE-ID) has determined that any future modifications will have an effect upon the Loss of Fluid Test Facility (LOFT), now known as the Containment Test Facility (CTF), at the Idaho National Engineering Laboratory, a property eligible for inclusion in the National Register of Historic Places, and has consulted with the Idaho State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (Council) pursuant to 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470f)

Now, therefore, the DOE-ID, the Idaho SHPO, and the Council agree that these modifications to LOFT shall be implemented in accordance with the following stipulations in order to take into account the effect of any undertaking on this historic property.

STIPULATIONS

DOE-ID will ensure that the following measures are carried out:

(1) LOFT Historical Report. DOE-ID will prepare a report which will (a) summarize the historic and scientific context of the LOFT research progams, (b) include a description of the LOFT physical facilities, and (c) initiate a database which will identify and locate documents, artifacts and key personnel associated with LOFT. The purpose of this report will be to serve as a reference to the history of LOFT, help to guide LOFT historic preservation and compliance activities, and support the nomination, by DOE-ID, of LOFT to the National Register of Historic Places.

(2) LOFT Historic Preservation Plan. DOE-ID will prepare a plan which will (a) identify the information and historic documentation currently available for LOFT, (b) make recommendations for the applicable standards, archiving of, and retrieval system for this documentation, (c) recognize DOE-ID's intent to seek uses for the LOFT facility for future research programs compatible with and based on its design and past uses, (d) recognize that all potential future options for LOFT and the nature and scale of the impact of these options on LOFT cannot be detailed at this time, and (e) outline DOE-ID commitments to define and consider any adverse effects of future alterations to LOFT (including, but not limited to, remodeling, expansion, disposal of records, facility contents and components, decomissioning, and demolition).

(3) Interim Historic Protection for LOFT. Until a nomination is submitted and supporting mitigation plans are prepared, as needed, DOE-ID will monitor the historic values of LOFT by (a) initiating data gathering and a

historic preservation plan (Stipulations 1 and 2), (b) seeking regular and timely consultation with SHPO when any signficant changes to LOFT are considered (Stipulation 4), (c) notifying any parties responsible for LOFT that planning for and coordination of historic preservation activities must be considered in advance of any alterations to LOFT, its supporting documents and artifacts, and (d) coordinating and planning for the inclusion of historic preservation activities and recommendations in any program that anticipates and implements the modification of LOFT.

(4) Consultation with the SHPO and ACHP. DOE-ID will initiate regular and timely consultation with the SHPO with regard to the physical status and historic integrity of LOFT. The DOE-ID and the SHPO will establish a reasonable scale defining what activities constitute significant modifications to LOFT in order to guide the level and content of DOE-ID responsibilities for notification and SHPO and ACHP response. Situations which will prompt consultation between the SHPO, ACHP, and DOE-ID will be, but are not limited to: (a) the process of nominating LOFT to the National Register (Stipulation 1), (b) preparation of the LOFT historic preservation plan (Stipulation 2), (c) anticipation of any significant modifications to the LOFT facility or effects on the documents and artifacts needed for the completion of a LOFT history (Stipulations 2 and 3).

TBD (5) Reporting/deliverables/schedules.

DOE-ID will complete the report and historic preservation plan for LOFT by 6/1/93 and submit copies of both to the Council and SHPO for review.

DOE-ID will submit the LOFT National Register nomination by 9/1/93.

(6) Conditions of Modification, Completion, and Termination of the MOA.

Implementation of the stipulations of this MOA and submittal of the evidence for this implementation to the Council and SHPO for comment and approval will meet the intent of this MOA. At this time, all signatories can agree to terminate or amend this MOA.

If a signatory to this MOA determines the terms of the MOA cannot be met or that a change is necessary to meet the requirements of the law, that signatory will immediately request that the consulting parties consider an amendment or addendum. Any necessary amendment or addendum will be executed in accordance with 36 CFR 800.5(e)(5).

If a dispute arises regarding implementation of the MOA, DOE-ID will consult with the objecting party to resolve the dispute. If the dispute cannot be resolved, further comments will be requested from the Council, in accordance with 36 CFR 800.6(b). Any party to this MOA may suspend it by 30 days advance written notice to the other consulting parties. Additional consultations will then occur in an effort to resolve any issues and re-implement the MOA in an amended form.

Execution of this Memorandum of Agreement and implementation of its terms evidence that DOE-ID has afforded the Council an opportunity to comment

on the nature and extent of planned and potential modifications to the LOFT facility and their effects on this historic property, and that DOE-ID is taking into account the effects of the undertaking on historic properties as required by Section 106 of the National Historic Preservation Act.

Advisory Council on Historic Preservation

By: ______________________________ Date: ____________

(Name and Title)

U.S. Department of Energy, Idaho Field Office

By: ______________________________ Date: ____________

(Name and Title)

Idaho State Historic Preservation Officer

By: ______________________________ Date: ____________

(Name and Title)

IDAHO STATE HISTORICAL SOCIETY

CECIL D. ANDRUS, Governor

OCT 0 7 1992

September 30, 1992

Director
210 Main St.
Boise, Idaho 83702
208-334-2682

Archaeology
210 Main St.
Boise, Idaho 83702
208-334-3847

Education
610 N. Julia Davis Dr.
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Genealogical Library
450 N. 4th St.
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Historic Preservation
210 Main St.
Boise, Idaho 83702
208-334-3847, 3861

Library and Archives
450 N. 4th St.
Boise, Idaho 83702
208-334-3356

Museum
610 N. Julia Davis Dr.
Boise, Idaho 83702
208-334-2120

Old Idaho Penitentiary
2445 Old Penitentiary Rd.
Boise, Idaho 83712
208-334-2844

Oral History
210 Main St.
Boise, Idaho 83702
208-334-3863

Publications
450 N. 4th St.
Boise, Idaho 83702
208-334-3428

Capt. Scott Hartford
AFCEE/ESEP
Building 1155
Brooks Air Force Base, Texas 78235-5000

RE: Draft Environmental Impact Statement - Space Nuclear Thermal Propulsion Program

Dear Capt. Hartford:

Thank you for providing our office with the draft Environmental Impact Statement (EIS) for the Space Nuclear Thermal Propulsion Program (SNTP). One of the alternative locations for the Particle Bed Reactor component of the SNTP program is the Contained Test Facility (CTF) on the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho. We fully support the proposed adaptive use of the CTF (LOFT) facility.

Sections 3.8.2 and 4.8.2 of the draft EIS indicate that the CTF facility is the only property that may be eligible for the National Register of Historic Places within the proposed SNTP project area. Since we feel the CTF facility is eligible for the National Register, we have been consulting with the Department of Energy and EG&G Idaho on the development of an agreement document that stipulates appropriate photographic and historical documentation of the structure. This mitigation is consistent with the measures described in Section 4.8.2.2.

If you have any questions, feel free to contact Suzi Neitzel at 208-334-3847.

Sincerely,

Kenneth J. Swanson
State Historic
Preservation Officer

KJS/spn
cc: Teresa Perkins, DOE, Idaho Falls
Clayton Marler, EG&G Idaho
Susanne Miller, EG&G Idaho

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INTEROFFICE CORRESPONDENCE

Date: December 23, 1992

To: T. J. Hill, MS 3413

From: B. L. Ringe, MS 2108 BLR

Subject: IDAHO STATE HISTORIC PRESERVATION OFFICE (SHPO) CONCURRENCE WITH RECOMMENDATIONS FOR THE SPACE NUCLEAR THERMAL PROPULSION (SNTP) TANK FARM AT THE LOSS OF FLUID TEST FACILITY (LOFT) ON THE IDAHO NATIONAL ENGINEERING LABORATORY (INEL) - BLR-77-92

Reference: B. L. Ringe letter to T. J. Hill, BLR-41-92, Archaeological Survey for the Space Nuclear Thermal Propulsion (SNTP) Tank Farm Northeast of the Loss of Fluid Test (LOFT) Facility on the Idaho National Engineering Laboratory (INEL), August 5, 1992

Enclosed is documentation from the Idaho SHPO indicating concurrence with my recommendations for construction of the SNTP Tank Farm near LOFT. In brief summary, the recommendations for the project were: 1) "all activity must be carefully restricted to the project area shown in BLR-41-92, Attachment (1)"; and 2) "if cultural materials are unexpectedly encountered at any time during subsurface excavation, work must come to a temporary halt until INEL archaeologists can assess their significance." The enclosure to this letter includes the original letter report, BLR-41-92, with Attachment (1) and a "Compliance Review Form" signed by the Idaho SHPO.

I can be reached at 6-9748 to provide additional information and answer any questions you might have.

po

Enclosure:
As Stated

cc: (w/o enclosure)
D. D. Keiser, MS 2209
C. F. Marler, MS 2108
Central Files, MS 1651
CRM Project File, EGG-92-34 (w/enclosure)
B. L. Ringe Letter File

INEL CULTURAL RESOURCE MANAGEMENT
COMPLIANCE REVIEW REQUEST

PROJECT: EGG-92-34, BLR-41-92, SNTP Tank Farm

We find this report of cultural resource historic preservation compliance action to be complete and concur with all stated recommendations and stipulations:

Susan P. Neitzel for Kenneth L. Swanson 12/16/92

Idaho State Historic Preservation Officer Date

We accept this report of cultural resource historic preservation compliance action with the addition of the following comments and stipulations:

Idaho State Historic Preservation Officer Date

EG&G Idaho

"Providing research and development services to the government"

INTEROFFICE CORRESPONDENCE

Date: August 5, 1992

To: T. J. Hill, MS 3413

From: B. L. Ringe, MS 2108 BLR

Subject: ARCHAEOLOGICAL SURVEY FOR THE SPACE NUCLEAR THERMAL PROPULSION (SNTP) TANK FARM NORTHEAST OF THE LOSS OF FLUID TEST (LOFT) FACILITY ON THE IDAHO NATIONAL ENGINEERING LABORATORY (INEL) - BLR-41-92

Reference: B. L. Ringe letter to C. F. Knutson, BLR-28-91, Archaeological Survey Coverage in the Vicinity of Test Area North (TAN) on the INEL, May 8, 1991

On July 21, 1992 and July 28, 1992, INEL archaeologists conducted an intensive archaeological survey of a 39 acre (157,500 m^2; 1,695298 ft^2) plot of land northeast of the LOFT facility at Test Area North (TAN) on the INEL. As Attachment (1) shows, the project area is located in the southern 1/2 of Section 13 and the northern 1/2 of Section 24, T6N, R32E, Butte County, ID. All work during the survey was performed in a manner consistent with the following authorities/standards: The Archaeological Survey: Methods and Uses, Standards and Guidelines for Identification of Historic Properties, Identification of Historic Properties: A Decision Making Guide for Managers (U.S. Dept. of Interior, National Park Service, National Advisory Council on Historic Preservation), the INEL Draft Management Plan for Cultural Resources (Dept. of Energy-Idaho Field Office), and informal guidance from the Idaho State Historic Preservation Office (SHPO).

The LOFT investigation was undertaken to identify and make preliminary evaluations of all cultural resources that might be adversely affected by construction of a hydrogen tank farm necessary for the operation of the Space Nuclear Thermal Propulsion (SNTP) project. During federally-sponsored ground disturbing projects such as this, laws like the National Historic Preservation Act, Archaeological Resource Protection Act, and National Environmental Policy Act mandate consideration of cultural resources that are deemed eligible to the National Register of Historic Places (NRHP) before they are damaged by project activities.

The LOFT project area is located in the northern portion of the INEL near the Birch Creek Sinks. During the Pleistocene (ca. 10-12,000 years ago) this area was submerged by the shallow waters of ancient Lake Terreton. Presently, the region is quite flat, with broad expanses of open ground and a thin scattering of river-rounded gravels. Ground visibility is unobscured,

even where low sagebrush, four-wing saltbrush, and various grasses are present in scattered patches. Much of the surveyed area has also been heavily disturbed by earth-moving equipment and sheet erosion.

Over the past decade, several surveys have been conducted in the TAN region, and more than 20 cultural resources have been identified (Reference). Prior to the start of fieldwork on the current project, a review of these documents was conducted at the INEL Cultural Resource Management (CRM) Office in Idaho Falls, ID. At this time, it was determined that archaeological inventory had been completed within a portion of the SNTP Tank Farm Project area. This included a 100-m wide zone surrounding the LOFT facility. This area is indicated in Attachment (1). Due to the flatness of the terrain in this area and in order to relocate the isolated prehistoric activity area recorded during the earlier project, the 100-m corridor within the SNTP project area was resurveyed.

The field methods employed during the SNTP survey were designed to provide intensive (90 - 100%) visual examination of the entire surface area needed for tank emplacement, thus ensuring that all cultural resources with visible surface remains were identified. This was accomplished through the use of systematic pedestrian transects with surveyors spaced at regular, 15-m intervals and proceeding in skirmish line fashion. Field examination was facilitated by trouble-free access and excellent ground visibility.

When cultural materials were encountered during the course of a transect, intensive searches ensued to ascertain the boundaries of the resource and to pinpoint diagnostic artifacts, artifact concentrations, cultural features, and any areas of post-depositional disturbance. Prior to formal recording procedures, all identified resources were classified as "isolates" (< 10 items in 100 m) or "sites" (≥ 10 items in 100 m), "historic" (< 150 years old) or "prehistoric" (≥ 150 years old), and marked accordingly on field survey maps. Intermountain Antiquities Computer System (IMACS) site forms were completed or updated for all resources located within the project area. When work on this project is completed, all forms of documentation will be submitted for permanent curation at the Southeastern Idaho Regional Archaeological Center (SIRAC) at the Idaho Museum of Natural History in Pocatello, ID. Survey and site records are also maintained at the INEL CRM Office in Idaho Falls, ID.

Archaeological reconnaissance within the SNTP Tank Farm project area resulted in the relocation of one previously recorded prehistoric activity area (10-BT-1234) and the recording of one previously unknown activity area (EGG-92-34). Both resource locations are shown in Attachment (1) and IMACS forms are included as Attachments (2) and (3). On the first day of the survey, a large, unrecorded prehistoric site associated with the Birch Creek Sinks was also briefly examined, but was not formally recorded because a shift in project location removed any threat of damage.

Under current working definitions, both cultural resources located within the modified SNTP Tank Farm project area are considered "isolated finds." Both are also located within a disturbed area where sheet erosion appears to occur regularly. Because both resource locations are believed to be limited to a disturbed surface context, neither is likely to yield any additional information and both are considered to be ineligible for nomination to the National Register of Historic Places.

Because no National Register-eligible cultural resources are located within the SNTP tank farm project area as currently proposed, ground disturbance is expected to have no effect on significant materials and archaeological clearance is recommended for all work. However, all activity must be carefully restricted to the project area shown in Attachment (1). This is very important because movement beyond the indicated project boundaries could result in damage to highly significant resources located nearby, particularly to the northeast of LOFT (where the SNTP tank farm was originally sited). In addition, if cultural materials are unexpectedly encountered at any time during subsurface excavation, work must come to a temporary halt until INEL archaeologists can assess their significance. Finally, in accordance with the National Historic Preservation Act, Section 106, (36 CFR 800.5[b]), a copy of this letter report should be forwarded to the Idaho State Historic Preservation Office for review and comment. These transmittals are customarily made through the INEL CRM Office in consultation with the project manager and T. L. Perkins of DOE-ID.

Please feel free to contact me at 6-9748 with any questions or additional requirements. I also await your advice in regard to the transmittal of these recommendations to the SHPO.

po

Attachments:
As Stated

cc: w/o attachments
C. A. Allen, MS 2208
C. F. Marler, MS 2108
D. L. Parks, MS 3510
CRM Project File EGG-92-34, w/attachments
Central File, MS 1651
B. L. Ringe Letter File

APPENDIX H

NATURE OF RADIATION AND ITS BIOLOGICAL EFFECTS

APPENDIX H
NATURE OF RADIATION AND ITS BIOLOGICAL EFFECTS

This appendix provides a discussion of the nature and effects of ionizing radiation. A glossary of terms can be found in Table H-1.

1.0 NATURE OF RADIATION

The basic unit of matter is the atom, consisting of a heavy central nucleus surrounded by electrons moving about the nucleus in orbits or a "cloud". The nucleus, containing nearly all the mass of the atom, is comprised of protons and neutrons, particles with virtually the same mass. Neutrons are electrically neutral; protons have a positive electrical charge, designated as +1. The electrons have less than 1/1,800 of the mass of protons and neutrons and a unit negative charge, i.e., -1. Complete atoms are electrically neutral with the same number of protons and electrons, referred to as the atomic number. (Atoms with unequal numbers of protons and electrons are called ions.) The chemical nature of the atom, and its identity as a chemical element, is determined by the atomic number. Hydrogen, for example, has one proton in its nucleus (and one orbiting electron); helium has two, lithium has three, etc.

Different nuclear species, or nuclides, are presented by their chemical element designation (their atomic number) and the sum of protons and neutrons in their nuclei. For example, the nuclide carbon-12 has six protons (the atomic number for carbon) and six neutrons; carbon-14 also has six protons but eight neutrons. Sometimes nuclides are denoted by other conventions utilizing the chemical symbols, e.g., C-12 and ^{12}C for carbon-12. Nuclides with the same number of protons but different numbers of neutrons are called **isotopes** of the chemical element. For example, hydrogen (one proton) has three isotopes with zero, one, or two neutrons, referred to as hydrogen-1, hydrogen-2, or hydrogen-3, respectively.

In some nuclides, the combination of protons and neutrons form a stable nucleus with tendency to change its configuration. Of the more than 2,000 nuclides identified to date, only about 280 are stable. In unstable nuclides, called **radionuclides**, the nucleus undergoes a spontaneous process known as radioactive decay to attain a more stable configuration. This radioactive decay is accomplished by the emission of particles and/or energy from the nucleus. The most usual particle emissions are referred to as **alpha** or **beta radiation**. Alpha particles consist of two protons and two neutrons; beta particles are electrons (originating from the transformation of a neutron into a proton in the nucleus, not from the orbiting cloud outside the nucleus).

Table H-1. Glossary of Terms

Nuclide:	An atomic nucleus with a specific number each of protons and neutrons.
Radionuclide:	Any nuclide which is unstable and has the potential to decay by radioactive emission.
Alpha Radiation: (Alpha particle)	Radioactive emission that consists of two protons and two neutrons (a helium nucleus).
Beta Radiation: (Beta particle)	Radioactive emission that consists of one electron.
Gamma Radiation: (Gamma ray)	Radioactive emission that consists of a packet of energy emitted as electromagnetic radiation (a photon).
Curie:	Unit of radioactivity equal to 3.7×10^{10} radioactive decay events per second.
Specific Activity:	The number of radioactive decays occurring in a unit mass (usually 1 gram) of radioactive material.
Half-life:	The time required for one-half of the radionuclides present in a radioactive sample to decay. This rate is a unique constant for each radioisotope.
Absorbed dose:	The amount of energy deposited in a unit mass (generally 1 kilogram) of material being irradiated.
Rad:	Unit of absorbed dose equivalent to the deposition of 0.01 joule of energy per kilogram of absorbing material.
Rem:	Unit of exposure to biological material calculated by multiplying the dose (in rads) by a quality factor which accounts for the biological effectiveness of the type of radiation producing the exposure.
External Exposure:	Exposure received to the whole body due to a radiation source which is physically located outside the exposed organism.
Internal Exposure:	Exposure received to either the whole body or an individual organ(s) from radioactive material which has been chemically incorporated into the body (through inhalation, absorption, etc.)
Maximally Exposed Individual (MEI):	The location of maximum radiological impact (highest dose) in unrestricted access areas. This location represents the site of the maximum exposure a person could receive if present throughout the exposure duration.
Somatic Effects:	Radiation-induced effects observed in the exposed individual, most commonly cancer.
Genetic Effects:	Radiation-induced effects observed in the progeny of exposed individuals or populations, including effects not apparent for multiple generations.

Excess energy is emitted from the nucleus in the form of "packets" of electromagnetic energy called photons, traveling at the velocity of light. This is referred to as gamma radiation.

An important characteristic which has been observed for this radioactive decay process is that it is probabalistic; that is, the precise time at which any specific unstable atom will decay cannot be determined. Also, in a sample of a number of the unstable atoms, it cannot be determined which of them will decay at any point in time. It has been observed that the ratio of the number of nuclei which decay in a unit of time to the number of undecayed nuclei remaining in the sample is a constant for each nuclide. This ratio is called the decay constant. The number of decays, or disintegrations, in a unit time is called the activity of the sample. Traditionally, activity is measured in curies, a term derived from the activity of 1 gram of radium and numerically equal to 37 billion disintegrations per second. Dividing the activity by the mass of the sample gives the specific activity for the sample. Since decay may be characterized by a constant, the time required for one-half of the nuclei in a sample to decay is also constant for each nuclide. This time is referred to as radioactive half-life for the nuclide.

2.0 EXPOSURE MECHANISMS

As the emitted particles and gamma radiation move away from the emitting nucleus, they collide with the atoms in the surrounding material. These collisions dissipate the kinetic energy of the particles and the electromagnetic energy of the gamma rays and, in the process, the atoms in the surrounding material may be damaged; that is, their structure may be changed such that their chemical nature and function is modified. The most common damaging effect is the removal of one or more of the surrounding electrons from an atom. As a result, the atom is no longer electrically neutral and is said to be ionized. The damage is related to the amount of energy deposited by the incident radiation. The deposited energy is referred to as the absorbed dose and is measured in rads; one rad is equal to the deposition of 0.01 joule of energy per kilogram (2.2 pounds) of the absorbing material.

If the absorbing material is living matter, the damage to the atoms may produce chemical changes which result in the death of living cells or other biologically harmful effects. Different types of radiation vary in their effectiveness in producing biological harm. Quality factors have been identified for various types of radiation which, when multiplied by the absorbed dose, account for these differences. This yields a measure of biological harm, referred to as dose equivalent, which is the same for all types of radiation and is quantified in terms of rem. This allows quantitative comparisons on the effects among the different types of radiation and the

determination of overall effective exposures when different types of radiation are involved.

Radioactive materials have the potential to produce an exposure either though external means, primarily from gamma photons and some high energy beta particles (both of which are penetrating and have long ranges), or internally due to deposition of alpha and beta particle emitting materials.

External doses are received equally throughout the body, and hence are referred to as whole-body doses. Such doses occur due to the penetrating power of the radiation involved. Externally, three mechanisms are of concern:

- Cloudshine is exposure due to gamma exposure from airborne radioactive materials. Although such airborne materials may be remote from the person being exposed, the long range of the gammas allows some radiation to reach the person.

- Groundshine is exposure due to gammas emitted from radioactive materials which have deposited on the ground.

- Immersion is similar to cloudshine, but is exposure to both gamma photons and high energy beta particles emitted by airborne radioactive materials. The exposed individual is actually within the radioactive cloud (rather than being located remotely, as is the case with cloudshine), which allows the addition of exposure due to the high energy beta particles.

Internal exposure is due to direct exposure of tissue to radioactive materials which have entered the body. Such materials can then chemically interact the way nonradioactive isotopes of the same elements would, and can be distributed to various parts of the body. Indeed, some materials exhibit a tendency to collect in a particular organ or system, thus concentrating the dosage received. This occurs with iodine, which preferentially accumulates in the thyroid, and various metals, phosphorus, and calcium, which accumulate in the bones. The whole body and individual organ doses received (since dose is based upon energy absorbed per unit mass of material different body parts can receive different exposures) can, therefore, vary widely. There are three exposure mechanisms of significance in analyzing internal exposure:

- Inhalation: Breathing of airborne radioactive materials (which would occur during immersion) allows deposition of particulates (in the lungs which may later be absorbed), and direct passage into the body of radioactive gases.

- **Ingestion**: Eating and drinking of contaminated plants, animals, and water can allow radioactive materials to enter the body through the digestive system. Once in the body, these materials behave as do their nonradioactive forms, and will interact chemically in the body.

- **Absorption**: Some radioactive materials can be absorbed directly through the skin, where they will again interact as other chemical materials in the body.

The environmental pathways for the contamination and exposure of individuals and the public in general are mutually dependent and interconnected by an array of subpathways. For instance, radionuclides deposited on ground surfaces can be sources of external dose through groundshine and sources of internal dose through the ingestion pathway. Internal dose through ingestion can occur directly as a result of ingestion of contaminated vegetation (through uptake of radionuclides from the ground) or indirectly as a result of ingestion of animal products from animals that have grazed on contaminated vegetation. Also, bodies of water contaminated by liquid releases can be sources of internal exposure, either directly through ingestion of contaminated water or indirectly through ingestion of contaminated aquatic foods or food crops contaminated by uptake of radionuclides in water used for irrigation (i.e., through the food chain).

External exposures are received only during the period of actual exposure to radioactive releases. Internal exposures, however, are more persistent, since radioactive materials that enter the body may take considerable time to be released. During this time radioactive decays continue to contribute to the total dosage received. As a result, the total dose from a radioactive release that a person receives has two components; the first is the external dose which is received during a short span of at most a few hours following release (although groundshine and resuspension inhalation may persist much longer), and the second is the long-term dose incurred as a result of internal deposition of radioactive materials. Such a dose may be distributed over a period of years.

The various organs of the body have different susceptibilities to harm from radiation, and different organs may receive different doses from internal exposure to radioactive material that they accumulate. However, by applying organ-specific weighting factors to individual organ doses, it is possible to determine a whole-body result as an indicator of health risk due to internal exposure. Combining this information with the total whole body dose received from external exposure yields the total dose due to a radioactive release. The millirem (mrem) (1,000 mrem = 1 rem) is used as the unit of measure for total dose. Total dose is calculated for all exposure

due to a radioactive release received by the individual in the subsequent 50 years (a 50-year committed dose).

The consequences of radiological releases are presented in two ways in the MELCOR Accident Consequence Code System (MACCS) analysis. First is the maximum-case potential exposure. This is referred to as the "maximally exposed individual" (MEI), and can be defined as the maximum potential whole-body dose that any individual can receive due to a release or series of releases. The summation of all release impacts in a year is used to determine the MEI, compliance with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) standard of 10 mrem, and compliance with the program goal of 2 mrem. Second, the total population dose is calculated by MACCS, which is the summation of the total dose to all exposed people, and is expressed as "person-mrems". This quantity can be used to determine the potential number of cancer fatalities and genetic defects in the exposed population which can be expected in subsequent years as a result of the total population exposure. This is accomplished by multiplying the population dose by the risk factors contained in the report issued by the Fifth Committee on the Biological Effects of Ionizing Radiation (BEIR V), which specifies a risk of 7.9×10^{-7} cancer fatalities per person-mrem, and 2.1×10^{-7} genetic defects per person-mrem.

3.0 HEALTH EFFECTS

If the whole body is exposed to a very high dose of radiation, death may occur immediately or within a matter of weeks. The dose that is lethal to about 50 percent of exposed individuals within 60 days after exposure is about 500,000 mrem (Abrahamson et al., 1989). If a limited area of the body is exposed briefly to a very high dose, death may not occur but there may be other early (sometimes called "acute") effects. For example, doses to the gonads (i.e., testes or ovaries) might cause sterility. Such effects are considered to be acute or short-term effects, and are due to massive damage to bodily systems. Short-term health effects are usually not observed below an acute dose of about 25,000 mrem, although changes in blood cells have been detected at doses as low as 5,000 mrem (National Council on Radiation Protection [NCRP], 1971). Estimated doses to the general population from normal operations of reactors and support facilities are in the range of fractions of mrem per year of operation and fall well below the level that would produce acute effects. Thus, acute effects due to normal reactor operations are not considered credible health threats.

Doses of radiation that are well below the thresholds needed to produce observable acute effects may have consequences later in life. Such doses can produce latent, or delayed, health effects. Delayed health effects can be broken down into two types: latent somatic effects and latent genetic effects.

Latent somatic effects are those directly observable in the exposed individual, the most important of which is the possible development of cancer years after exposure. Although the basic processes by which radiation induces cancer may not be fully understood, studies of the survivors of the atomic bombings in Japan, patients exposed to radiation, uranium workers, and workers in the radium-luminizing industry (1930s) have established that the incidence of cancer is greater in groups who were exposed to high doses of radiation in earlier years than in groups who were not exposed.

Latent genetic effects are those that are observed in the offspring of exposed individuals, including effects that may not become apparent for several generations. Latent genetic effects are due primarily to mutations in the genetic material of exposed persons.

The data that established a link between cancer, genetic effects, and radiation were collected for persons who received high doses; no equivalent direct statistical link has been established between cancer and low doses of radiation. However, a conservative assumption is that the probability of a delayed effect is proportional to dose (linear dose-risk relationship); therefore, a reduction in dose by one half would result in half the number of persons developing the effect, a reduction by ten would result in a tenth the number of persons developing the effect, and so on. Also, a linear dose-risk relationship would enhance the meaningfulness of the population dose as a measure of radiation effects on a population, since the predicted effects would be based upon the population exposure regardless of how the exposure was distributed among the individuals.

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